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PENALTY STRUCTURES AND DETERRENCE IN A TWO-STAGE MODEL: EXPERIMENTAL EVIDENCE[†]

Abstract

Increasing penalty structures for repeat offenses are ubiquitous in penal codes, despite little empirical or theoretical support. Multi-period models of criminal enforcement based on the standard economic approach of Becker (1968) generally find that the optimal penalty structure is either flat or declining. We experimentally test a two-stage theoretical model that predicts decreasing penalty structures will yield greater deterrence than increasing penalty structures. We find that decreasing fine structures are more effective at reducing risky behavior. Additionally, our econometric analyses reveal a number of behavioral findings. Subjects are deterred by past convictions, even though the probability of detection is independent across decisions. Further, subjects appear to take the two-stage nature of the decision making task into account, suggesting that subjects consider both current and future penalties. Even controlling for the fine a subject faces for any given decision, being in a decreasing fine structure has a significant effect on deterrence.

JEL Classification: C91, K10 and K42

Keywords: crime and punishment, deterrence, experimental evidence and repeat offenders

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1. Introduction

Most legal systems punish repeat offenders more severely for the same offense than first-time offenders. Increasingly harsh penalties characterize traditional crimes such as theft and murder, but also violations of environmental and labor regulations as well as tax evasion. This principle of escalating sanctions based on offense history is so widely accepted that it is embedded in many penal codes and sentencing guidelines.[1] For the literature on optimal law enforcement following the pioneering work of Becker (1968), sanctions that increase with the number of offenses are a puzzle.[2] Multi-period models of criminal enforcement based on the standard economic approach generally find that the optimal penalty structure is either flat or declining. In this paper, we take an experimental approach with a standard Becker type framework to assess whether the declining or flat penalty structures implied by theory lead to greater levels of deterrence than the commonly used increasing penalty structures.

By adding additional assumptions in a Becker-inspired framework, some researchers have developed models that find increasing penalties to be optimal.[3] Polinsky and Shavell (1998) assume that the government observes an agent's age and her criminal record; under certain conditions, they find it is optimal to punish old first-time offenders less severely than old repeat-offenders and young first-time offenders. Polinsky and Rubinfeld (1991) assume that offenders differ in their propensities to commit socially undesirable acts, and an escalating fine structure may be useful as a screening device. Several studies allow for the possibility that first-time offenders have committed their crimes by accident (Rubinstein 1979; Chu, Hu, and Huang, 2000; Emons, 2007; Ben-Shahar 1997; and Bebchuk and Kaplow 1993) or through experimentation (McCannon. 2009; Miceli 2013). In such cases, increasing penalties might be optimal. Another group of models incorporate a learning-by-doing effect of crime (Baik and Kim 2001; Mungan, 2010; Garoupa and Jellal 2004), which may justify increasing sanctions under certain

[1] For example, in the US under the Clean Water Act, the maximum penalties are doubled for subsequent offenses and the Immigration Reform and Control Act imposes minimum fines of $250 for a first offense, $2000 for a second offense, and $3000 for subsequent offenses. In Switzerland, the fine for travelling without a valid ticket on a regional train is 100 SFR for the first offense, 140 SFR for the second offense, and 170 SFR for any further offense. See Polinsky and Shavell (1998) for more examples.

[2] See, e.g., Garoupa (1997) or Polinsky and Shavell (2000) for surveys of the earlier law enforcement literature.

[3] Rubinstein (1980) shows that within the context of Becker's model there exists a utility function for offenders that makes an escalating penalty scheme optimal. This special result, however, cannot account for the pervasiveness of the practice.

conditions.[4] A final strand of literature justifying escalating penalties focuses on the stigma effect of a criminal conviction, which acts as a supplement to formal criminal penalties in deterring some offenders (Rasmussen, 1996; Dana, 2001; Funk, 2004; and Miceli and Bucci, 2005).[5]

While some models have justified increasing penalties with a variety of special assumptions, standard Becker type models imply declining penalties are optimal.[6] In a model without additional assumptions and where criminal acts are strictly undesirable, Emons (2003, 2004) shows that optimal fines are actually declining over a two period time horizon.[7] We use the basic framework of the Emons (2003) to motivate our experimental design that examines individual responses to increasing, flat, and decreasing penalty structures. In the Emons (2003) model, agents live for two stages. In each stage, they may commit an offense. The benefit to the offender is smaller than the harm caused by the offense. The act is thus inefficient and agents should be deterred. The agents are wealth constrained; increasing the fine for the first offense means a reduction in the sanction for the second offense and vice versa.[8] The government seeks to minimize enforcement cost as measured by the probability of apprehension. This model has the result that the optimal sanction scheme is decreasing rather than increasing in the number of offenses. In fact, Emons (2003) shows that the optimal sanction is where the first offense equals the entire wealth while the sanction for the second offense is zero.

Note that Becker's (1968) maximum fine result applies to the model of Emons (2003); in order to minimize enforcement cost, the government uses the agent's entire wealth for sanctions.[9] This means that a money penalty imposed for one offense reduces the amount a person can pay in fines for another offense. Since the probability of being detected for a first offense is higher than the probability of being detected for two offenses, a high penalty for the first offense is a more

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[4] One argument for the learning-by-doing model as an explanation for increasing sanctions is that as offenders learn from their crimes, the costs of apprehension increase and thus the penalties should also increase. A potential offsetting effect, however, is that enforcers will likely pursue repeat offenders more vigorously which suggests optimal penalties are decreasing (Dana, 2001; Mungan, 2010).

[5] As an example, the legal employment opportunities of an offender are diminished after the first offense, which potentially increased the relative benefit of a crime. Thus, higher penalties are necessary to deter after the first offense because the stigma effect has already been incurred.

[6] See, for example, Burnovski and Safra (1994).

[7] Motchenkova (2014) shows that the results of Emons (2003, 2004) also hold for more than two periods; however, she does not allow for history dependent strategies.

[8] The assumption that total penalties cannot exceed wealth is not unrealistic, as individuals can only pay sanctions up to their net worth or be incarcerated for the term of their natural life.

[9] If sanctions are less than total wealth, sanctions can be increased and the probability of apprehension lowered so as to keep deterrence constant.

effective use of the scarce (money penalty) resource.[10] This theoretical result is thus in stark contrast to the practices embodied in penal codes.

In light of this gap between theory and practice, we design an experiment to test the predictions of a parameterized version of the model in Emons (2003). We focus on whether decreasing fine structures yield greater deterrence, as predicted by the model, or whether increasing fine structures are better at deterring risky behaviors, as suggested by most legal systems.[11] We are not aware of any other experimental study that has addressed this question.[12] Subjects choose whether or not to commit a crime, which is described as "taking a chance" in a context free version of the experiment or described as specific actions in three contextual versions of the experiment. There is a fixed, independent probability of being caught in each of two decision-making stages. The penalty for the first offense and second offense after being caught take on various values, and always sum to the agent's wealth.

In general, our results confirm the predictions of Emons (2003). We find that decreasing penalty structures lead to the greatest level of deterrence. However, these decreasing penalty structures have the highest rate of repeat offenses, since the second offense has a relatively small fine. We also perform analyses on the individual decision of whether to commit the offense. In addition to finding greater levels of deterrence when subjects are faced with declining penalty structures, we observe greater offense levels when subjects are male, less risk averse, and have committed offenses in previous rounds. We also observe that being caught under previous penalty structures has a deterrent effect in the current penalty structure, even though the probability of being caught and the fine are independent of previous rounds.

[10] Denote the probability of detection by p. The probability that the first act is detected is p; the probability that the second act is detected is p^2 with $p^2 < p$ for all $p \in (0,1)$.

[11] In addition to deterring criminal behavior, legal systems also seek to sanction those who violate laws with criminal penalties and fines. For the purposes of this paper, we abstract away from the notion of punishment and assume that legal systems solely seek to optimize deterrence.

[12] Behavioral and experimental economics have been used to investigate theoretical concepts in many sub-disciplines within economics, but are less prevalent in studying issues within law and economics. See Tietelbaum and Zeiler (forthcoming), Camerer and Talley (2007), McAdams and Ulen (2008), Arlen and Taylor (2008), and Engel (2013) for reviews of the literature. Limited work has focused on the exact nature and context of enforcement. In a large-scale field experiment examining different enforcement strategies to collect fees from consumers, Fellner et al. (2013) show that making a high detection regime salient to potential offenders has a significant deterrence effect.

In the next section, we present a parameterized version of the model that we test. Section 3 describes the experimental design, Section 4 presents results, and in the final section, we offer a discussion of our results and conclude.

2. Parameterized Model

We assume that agents are risk neutral and have initial wealth of $10.[13] Agents maximize utility by making decisions in two stages. In each stage, an agent can engage in an illegal activity with a monetary benefit of $2. The government seeks to deter individuals from engaging in the illegal activity by choosing a two-part fine structure of the format (f_1, f_2).[14] The first sanction, f_1, applies to the first detected offense, and the second sanction, f_2, applies to the second detected offense. The government cannot confiscate more than the agent's wealth, thus $f_1 + f_2 \leq 10$. Moreover, the government sets the level of detection such that the probability an offense will be detected, p, is 1/3.[15]

Below we derive optimal decisions for each of five possible fine structures, (f_1, f_2). For all fine structures we set $f_1 + f_2 = 10$.[16] Since we hold p and the overall level of the fines constant, the variation in observed behavior (i.e., the decision to commit) is attributed to whether fines are increasing or decreasing. To derive the optimal decision for each structure, we compare expected utility levels associated with all possible strategy sets, (a_1, a_2), where a_1 represents the action taken by the agent in the first stage and a_2 represents the action taken by the agent in the second stage. (a_1, a_2) are represented by 0 if the agent does not engage in the illegal activity and 1 if the agent does engage in the illegal activity. Thus, there are four possible strategy sets to consider that are not history dependent: (0, 0), (1, 1), (0, 1), and (1, 0). Note that in all cases U(0,0) = $10 since the agent will not earn extra money without engaging in the illegal activity but also will not be fined. The agent also can choose between two history dependent strategies. First, she commits the criminal act in stage 1 and then commits the criminal act in stage 2 only if she *is not* detected

[13] Although the model assumes agents are risk neutral, the theoretical predictions of the model do not change unless people are *extremely* risk averse, which is not the case with this group of subjects.
[14] We assume the harm from the act is greater than $2 so that the act is inefficient. Full deterrence is called for and the problem of over-deterrence does not arise.
[15] Behavior is anticipated to vary with the probability of apprehension (Bar-Ilan and Sacerdote, 2001). We reduce this dimension of variation by holding the probability fixed throughout the experiment.
[16] We set total fines equal to initial wealth to be consistent with the model of Emons (2003).

in stage 1. We call this strategy (1, (1|not detected; 0|otherwise)). Alternatively, she commits the act in stage 1, and then commits the act in stage 2 only if she *is* detected in stage 1. We call this strategy (1, (0|not detected; 1|otherwise)).[17]

First we consider optimal behavior under the sanction scheme ($1, $9). When the agent first commits a crime and is detected, she is sanctioned $1; a second detected offense carries a sanction of $9.

U(0, 0) = **$10**

E[U(1, 0)] = E[U(0, 1)] = $10 + $2 – $1**p* = **$11.67**

E[U(1, 1)] = $10 + $2 − $1**p* + $2 – *p* ($1(1 − *p*)+$9* *p*) = **$12.44**

E[U(1, (1|not detected; 0|otherwise))] = $10 + $2 – *p*$1* + (1 − *p*)($2 – $1**p*) = **$12.78**

E[U(1, (0|not detected; 1|otherwise))] = $10 + $2 – $1**p* + *p*($2 – $9**p*) = **$11.33**

Prediction 1: Under the increasing sanction scheme ($1, $9), agents will choose the history-dependent strategy (1, (1|not detected; 0|otherwise)).

Next we consider optimal behavior under the sanction scheme ($3, $7). When the agent first commits a crime and is detected, she is sanctioned $3; a second detected offense carries a sanction of $7.

U(0, 0) = **$10**

E[U(1, 0)] = E[U(0,1)] = $10 + $2 – $3**p* = **$11**

E[U(1, 1)] = $10 + $2 − $3**p* + $2 – *p* ($3(1 − *p*)+$7* *p*)) = **$11.56**

E[U(1, (1|not detected; 0|otherwise))] = $10 + $2 – *p*$3* + (1 − *p*)($2 – $3**p*) = **$11.67**

E[U(1, (0|not detected; 1|otherwise))] = $10 + $2 – $3**p* + *p*($2 – $7**p*) = **$10.89**

Prediction 2: Under the increasing sanction scheme ($3, $7), agents will choose the history-dependent strategy (1, (1|not detected; 0|otherwise)).

[17] Note that both of the history-dependent strategies involve the agent committing the crime in the first stage, since there is no chance of paying a fine in the first stage if the crime is not committed.

Next we consider optimal behavior under the sanction scheme ($5, $5). When the agent first commits a crime and is detected, she is sanctioned $5; a second detected offense carries a sanction of $5.

U(0, 0) = **$10**

E[U(1, 0)] = E[U(0,1)] = $10 + $2 – $5*$p$ = **$10.33**

E[U(1, 1)] = $10 + $2 − $5*$p$ + $2 – p ($5(1 − p)+$5* p)) = **$10.67**

E[U(1, (1|not detected; 0|otherwise))] = $10 + $2 – p*$5 + (1 − p)($2 – $5*$p$) = **$10.56**

E[U(1, (0|not detected; 1|otherwise))] = $10 + $2 – $5*$p$ + p($2 – $5*$p$) = **$10.44**

Prediction 3: Under the constant sanction scheme ($5, $5), agents will choose the strategy (1,1).

We now turn to decreasing sanction schemes, where the first offense is punished more harshly than the second one. We consider optimal behavior under the sanction scheme ($7, $3). When the agent first commits a crime and is detected, she is sanctioned $7; a second detected offense carries a sanction of $3.

U(0, 0) = **$10**

E[U(1, 0)] = E[U(0,1)] = $10 + $2 – $7*$p$ = **$9.67**

E[U(1, 1)] = $10 + $2 − $7*$p$ + $2 – p ($7(1 − p)+$3* p)) = **$9.78**

E[U(1, (1|not detected; 0|otherwise))] = $10 + $2 – p*$7 + (1 − p)($2 – $7*$p$) = **$9.44**

E[U(1, (0|not detected; 1|otherwise))] = $10 + $2 – $7*$p$ + p($2 – $3*$p$) = **$10**

Prediction 4: Under the decreasing sanction scheme ($7, $3), agents are indifferent between the strategy (0, 0) and the history-dependent strategy (1, (0|not detected; 1|otherwise)).

Finally, we consider the steeply decreasing sanction scheme ($9, $1). When the agent first commits a crime and is detected, she is sanctioned $9; a second detected offense carries a sanction of $1.

U(0, 0) = **$10**

E[U(1, 0)] = E[U(0,1)] = $10 + $2 – $9*$p$ = **$9**

E[U(1, 1)] = $10 + $2 − $9*$p$ + $2 – p ($9(1 − p)+$1* p)) = **$8.89**

E[U(1, (1|not detected; 0|otherwise))] = $10 + $2 – p*$9 + (1 − p)($2 – $9*$p$) = **$8.33**

$$E[U(1, (0|\text{not detected}; 1|\text{otherwise}))] = \$10 + \$2 - \$9*p + p(\$2 - \$1*p) = \mathbf{\$9.56}$$

Prediction 5: Under the steeply decreasing sanction scheme ($9, $1), agents will choose the strategy (0,0).

The five predictions above show that the decreasing sanction schemes achieve better deterrence than the constant or the increasing schemes within this model. The intuition for this result is straightforward. The agent can only be apprehended for the second crime after she has already been apprehended for the first crime, meaning that the agent pays the first sanction with probability 1/3 and the second sanction with probability 1/9. Since paying the first fine is more likely than paying the second one, shifting resources from the second to the first sanction increases deterrence.[18] Note that these predictions assume rational forward-looking agents who view each stage within a penalty structure as interrelated; whether an agent offends in the first stage depends on the fines for the second stage. Next, we describe the experimental design used to test the predictions of this parameterized model.

3. Experimental Design

We conducted 35 experimental sessions at the College of William and Mary in Virginia, USA.[19] Participants were recruited from on-campus advertisements to participate in paid economics experiments. A total of 367 undergraduate students participated in the experiment and no person was permitted to participate in more than one session. The number of subjects in each session ranged from 4 to 14, and sessions lasted approximately 45 minutes. Subjects began each session by completing the Holt and Laury (2004) lottery choice experiment using the Internet-based Veconlab website.

[18] Emons (2003) determines the optimal sanction scheme in the sense of Becker (1968), i.e., the scheme that minimizes the cost of enforcement. In terms of our example, the probability of apprehension is minimized at 0.25 by choosing the (10,0) sanction scheme. However, in this experiment we fix the probability of apprehension at 1/3 and focus on the potential differences in deterrence from increasing versus decreasing penalty structures.

[19] We also conducted versions of this experiment at the University of Bern in Switzerland. We do not include the Swiss subjects in the current analysis because the number of Swiss subjects who participated are relatively low due to higher payment values. In addition, Swiss subjects were found to be significantly less risk averse than subjects in the United States. However, results on the relationship between penalty structure and deterrence from Bern are quite similar to those in Virginia.

After completing the lottery choice experiment to elicit a measure of individual risk-aversion, subjects completed another computerized experiment that was programmed and administered using z-tree (Fischbacher, 2007). The experiment was divided into five periods, with each period corresponding to a different enforcement regime (i.e., fine structure).[20] Subjects were endowed with $10 at the beginning of each period, and they faced two decision-making stages within the period. In a context free treatment, subjects could "take a chance" or not. Every time a subject chose to take a chance, she earned an additional $2 but she also faced a 1 in 3 chance of being "checked" and financially penalized. Thus, a subject could earn an additional $4 but could also pay two separate fines each period. In addition to the context free treatment, there were three additional treatments that varied only in the way the decision was presented to subjects. In the context treatments, decisions were presented as "driving over the speed limit," "cheating on your taxes," and "shoplifting." Each subject made decisions using only one of the four contexts. We ran both context free and framed experiments to examine how subjects treated specific proscribed behavioral environments in comparison to a sterile risk environment, since previous research has shown considerable differences (see, for example, Sonneman et al., 2010). The complete instructions for the context-free experiment are available in the Appendix.

All subjects made decisions for each of five different enforcement regimes denoted (1,9), (3,7), (5,5), (7,3) and (9,1), where the first number is the fine associated with the first detected offense and the second number is the fine for the second detected offense within a given period. At the beginning of each period, subjects were told the relevant fines for the two stages in that period, but they were not told fines for future periods. In the discussion that follows, we refer to the enforcement regimes with a higher fine for the second offense as *increasing* fine regimes (i.e., (1,9) and (3,7)) and the regimes with a higher fine for the first offense as *decreasing* fine regimes (i.e., (7,3) and (9,1)).

To control for possible order effects, there were two treatments that differed in the order in which enforcement regimes were presented to subjects. Approximately half of the subjects saw the five regimes in the order treatment presented above, with relatively low first-offense fines in periods 1 and 2. The other subjects saw the five regimes in the following order treatment: (9,1), (7,3), (5,5), (3,7) and (1,9). To avoid wealth effects, subjects were told that one of the five

[20] At the beginning of each session, subjects also participated in a "practice" period with hypothetical earnings.

periods would be randomly chosen for payment at the end of the experiment. Subject earnings averaged $10.54 for the deterrence experiment.

4. Results

In this section we examine the rate at which subjects choose actions that are consistent with the theoretical behavior, present the rates at which subjects offend under the various penalty structures, and then disaggregate subject decisions to examine the effect of penalty structures on individual-level choices. Regardless of whether or not the experiment was presented to subjects with context, for ease of exposition we use the term “offend” to describe all subject choices that correspond to committing the crime.

4.1 Theoretical Predictions and Observed Behavior

We begin our empirical analysis by examining the frequency with which behavior is consistent with the theoretically predicted strategy. Table 1 provides the strategy that is predicted by the theoretical framework as well as the proportion of subjects in all sessions (with and without context) that play the predicted strategy. Note that for some penalty structures, there are multiple behaviors that are consistent with the strategy predicted by theory. We only observe the actual behavior, not a history dependent strategy. Thus, if theory predicts a history dependent strategy such as (1, (1|not observed; 0|otherwise)), we observe whether the subject offends in the first stage and how the subject responds to whether they are caught in the first stage. If the subject offends in the first stage, is caught, and then chooses not to offend in the second stage, then the observed behavior is consistent with the predicted strategy. Upon first inspection, we find that subjects facing the decreasing penalty structures are most likely to follow the theorized strategy, but subjects follow predicted strategies to various degrees for the other penalty structures.

Table 1. Comparison of Theory and Behavior

Penalty Structure	Predicted Strategy	Behaviors Consistent with Predicted Strategy (% of total observations within penalty structure)
(1,9)	*Prediction 1:* *(1, (1|not observed; 0|otherwise))*	• Offend in the first stage and not detected, also offend in the second stage (35%) • Offend in the first stage and detected, do not offend in the second stage (23%) • **Overall rate of consistency = 58%**
(3,7)	*Prediction 2:* *(1, (1|not observed; 0|otherwise))*	• Offend in the first stage and not detected, also offend in the second stage (27%) • Offend in the first stage and detected, do not offend in the second stage (19%) • **Overall rate of consistency = 46%**
(5,5)	*Prediction 3: (1, 1)*	• Offend in both stages regardless of whether or not detected in first stage (18%) • **Overall rate of consistency = 18%**
(7,3)	*Prediction 4: (0,0) or* *(1, (0|not observed; 1|otherwise))*	• Never offend (64%) • Offend in the first stage and detected, also offend in the second stage (5%) • Offend in the first stage and not detected, do not offend in the second stage (10%) • **Overall rate of consistency = 79%**
(9,1)	*Prediction 5: (0, 0)*	• Never offend (68%) • **Overall rate of consistency = 68%**

Subjects who face a constant fine structure (5,5) are least likely to follow the theorized strategy, with only 18 percent of the subjects following the strategy of offending in both stages, regardless of whether or not they were detected in the first round. As shown in the model section, there is a relatively small difference in expected payoffs for the best and second best strategy under the (5,5) penalty structure. The second best strategy is (1, (1|not detected; 0|otherwise)) and that strategy has an associated expected payoff of $10.56, compared to the highest expected payoff of $10.67. Interestingly, only 16% of subjects follow the second best strategy in this case, so it does not appear to be the small difference in expected payoffs that draws subjects away from the optimal strategy. Instead, the most commonly used strategy in the (5,5) penalty structure is for subjects *never* to commit an offense and have a payoff of $10. This strategy of (0, 0) was followed by 46% of the subjects.

Another possible explanation for inconsistencies between theory and observed behavior is that agents are myopic and treat each stage as a one-shot decision. In this case, given that the benefit of the crime is $2 and the probability of apprehension is 1/3, myopic risk neutral agents will commit the act as long as the fine is less than $6. In situations where myopic behavior predicts offenses will be committed, we observe offense rates of 75%, 61% and 35% with the $1 fine, the $3 fine, and the $5 fine, respectively. In situation where we expect no offenses with myopic behavior, we observe a 21% offense rate with the $7 fine and a 19% offense rate with the $9 fine. These offense rates do not support the idea that people consider each stage decision separately. However, these aggregate results also do not take individual-specific characteristics and decision-making biases into account.

In addition to examining aggregate behavior, we next focus on whether individuals make the same decision each time they face the same fine. Table 2 displays the consistency of behavior across the two stages of the experiment when subjects face the same fine at different stages. Column (1) shows the total number of subjects who choose not to offend in stage 1 for each penalty structure. Recall that a total of 367 subjects participated in each of the penalty structures, and risk neutral agents who treat each stage as a one-shot decision should offend as long as the fine faced is less than $6. Thus, the numbers in column (1) are somewhat higher than expected for the (1, 9), (3, 7) and (5, 5) penalty structures, as we might expect very few subjects to not offend under these penalty structures, and lower than expected for the (7, 3) and (9, 1) structures where we would expect most subjects to not offend.

Of those subjects who do not offend in stage 1, column (2) shows the number who also did not offend in stage 2. Note that these subjects face the same fine in stage 2 as they did in stage 1, since they did not offend in stage 1. Thus, we would expect rational subjects who treat each stage as a one-shot decision to make the same decisions in these two stages. Column (3) presents the percentage of subjects that made consistent decisions across stages when facing the same fine. A surprisingly large number of subjects make different decisions across the two stages, despite facing the same fine. The lack of consistency in not offending across these two columns could be evidence of learning or evidence that the two-stage nature of the problem affects the way subjects make each individual decision. Note also that the lack of consistency across columns (1) and (2) is largest for the decreasing fine structures.

Table 2. Behavioral Consistency Across the Two Stages of the Experiment

	(1)	(2)	(3)	(4)	(5)	(6)
Fine Structure	Do not offend in Stage 1	Do not offend in Stage 1 and do not offend in Stage 2	% Consistent decisions = (2)/(1)	Offend in Stage 1 and are not caught	Offend in Stage 1 and are not caught and also offend in Stage 2	% Consistent decisions = (5)/(4)
(1,9)	54	26	0.48	211	127	0.60
(3,7)	114	72	0.63	166	99	0.60
(5,5)	215	169	0.79	109	42	0.39
(7,3)	284	236	0.83	55	18	0.33
(9,1)	295	251	0.85	54	18	0.33

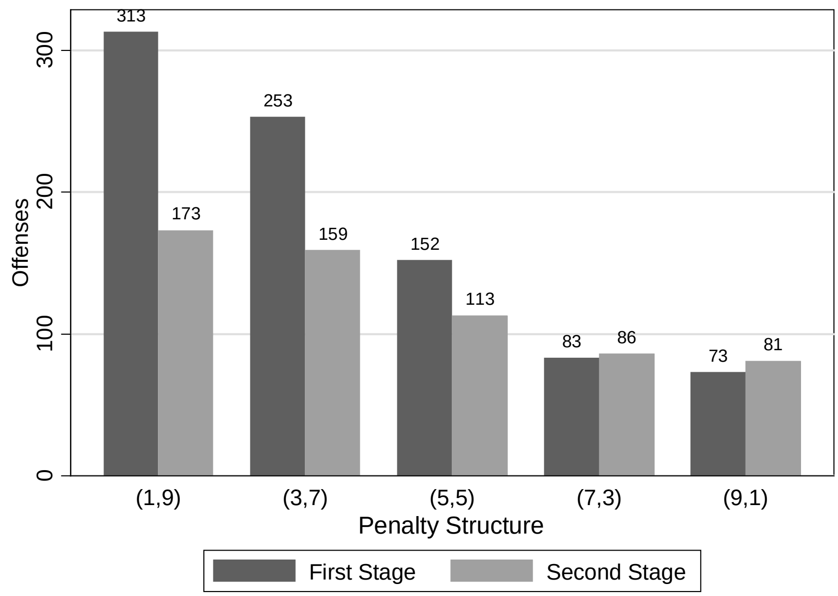
The right hand side of Table 2 examines an alternative situation where subjects face the same fine in both stages of decision-making. Column (4) shows the number of subjects who offend in stage 1, but are not caught, and Column (5) shows how many of those people go on to offend again in stage 2. Again, with risk neutral subjects who treat each stage as independent, we expect everyone to offend in stage 1 under the increasing and constant fine structures and no one to offend under the decreasing fine structures. Since column (4) is conditional on subjects not being caught in stage 1, the same risk neutral predictions hold for column (5). We find even higher degrees of inconsistency in offending between the two stages with increasing penalty structures, however, less inconsistency in the constant and decreasing fine structures for this comparison of offending when subjects are facing the same fine. In addition to learning and taking the two-stage decision into account, another possible explanation for inconsistency here is an irrational concern by subjects that they are more likely to be caught in stage 2 after avoiding detection in stage 1.[21] In section 4.3 we attempt to isolate these separate effects using econometric analysis.

[21] Another situation where subjects make decisions made under the same fine is across fine structures. For example, a subject faces the $1 fine in the (1, 9) scenario and also faces the $1 fine in the (9, 1) scenario. This comparison is complicated by a selection problem; in order to face the $1 fine in the (9, 1) scenario, a subject must offend and be detected in the first stage. Thus, it is difficult to disentangle the effects of selection, learning, and any effect the detection might have on decision making in the second stage.

4.2 *Deterrence*

We now turn our attention to identifying which enforcement regimes yield the greatest level of deterrence. Figure 1 shows the total number of offenses by decision stage and enforcement regime. Under each enforcement regime subjects make two decisions, which we call the first stage and the second stage. The most striking observation is that increasing fine regimes have over twice as many offenses as decreasing fine regimes. The constant fine mechanism has fewer offenses relative to increasing enforcement regimes, but has more offenses when compared to decreasing fine regimes. In short, we find descriptive evidence consistent with the theoretical prediction that a decreasing, rather than increasing penalty structure, yields greater specific deterrence. [22]

Figure 1: Total Offenses by Decision Stage and Penalty Structure



Note: For each penalty structure, there are 367 subjects making decisions in two stages, thus the maximum number of offenses for each decision stage is 367.

Figure 1 also shows how offense rates vary across the two stages of decision-making. Note that the number of offenses falls sharply between the first and second stage in the increasing fine regimes. This is not surprising since first stage offense rates are relatively high in these two

[22] We also find statistical evidence that decreasing penalty structures yield greater deterrence. Wilcoxon tests show that the average number of offenses are significantly different across all but one of the penalty structures, with p-values all smaller than 0.001. The only exception is the pair (7,3) and (9,1), which does not have significantly different numbers of offenses (p-value equal to 0.323).

regimes, which means that relatively more people get caught and face the high penalty associated with a second offense in the second stage of these regimes. On the other hand, the number of offenses is fairly constant across the two decision stages in the decreasing sanction schemes. While committing an offense in the first stage is not optimal under these schemes, if a subject offends and is caught in the first stage, it is optimal to recommit in the second stage. Note, however, that Figure 1 provides no information about which fine subjects face in the second stage, since it does not distinguish between people who committed an offense and were caught in the first stage and those who were not caught.

Table 3 provides the number of subjects that face the first fine or second fine in stage 2. Subjects who face the first fine in stage 2 either did not commit an offense or they committed an offense and were not caught in the first stage. Subjects who face the second fine in the penalty structure represent those who committed an offense and were caught in the first stage. Consistent with Figure 1, the number of subjects facing the second fine in stage 2 is decreasing with the first fine, as fewer subjects commit an offense at all in the first stage when facing a decreasing penalty structure ((7,3) or (9,1)).

Table 3: Number of Subjects Facing Each Fine in Stage 2

Fine Structure	Face First Fine in Stage 2	Face Second Fine in Stage 2
(1,9)	265	102
(3,7)	280	87
(5,5)	324	43
(7,3)	339	28
(9,1)	348	19

Figure 2 focuses on second stage decisions and provides information about offenses and the specific fine faced by the subject. Panel A of Figure 2 shows that among subjects who face the first fine, there are significantly more second stage offenses in the increasing penalty structures than in the decreasing penalty structures.[23] For those subjects who face the second fine,

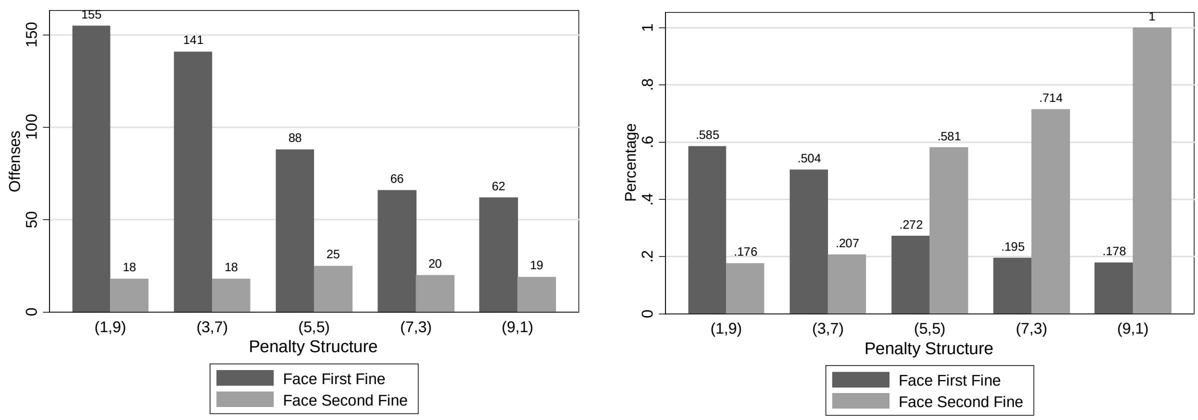
[23] Wilcoxon tests show that the number of second stage offenses for subjects facing the first fine are significantly higher in penalty structures (1,9) and (3,7) relative to the other penalty structures. In addition, the constant fine structure (5,5) results in significantly more second stage offenses than the decreasing penalty structures. The

very few second stage offenses are committed overall, but there are more second stage offenses in the constant and decreasing penalty structures than in the increasing penalty structures.[24]

Figure 2: Second Stage Offenses by Penalty Structure

Panel A: Total Offenses

Panel B: Offense Rates



Panel B of Figure 2 presents the second stage offense data in percentage terms. For each bar in panel A, we divide the number of offenses committed in that scenario by the total number of decisions made. This figure reveals that recidivism rates among those who were caught in the first stage are much higher in the decreasing penalty structures than in the increasing penalty structures.[25] For example, all 19 subjects who offended and were caught in the first stage under the (9,1) penalty structure offended again in the second stage. As noted above, given that a subject makes the irrational decision to commit a first stage offense in the (7,3) or (9,1) penalty structure and gets caught, the optimal second stage decision is to recidivate.

Recall that some subjects participated in experimental sessions where the action was presented with an illegal context (speeding, cheating on taxes, or shoplifting). Figure 3 presents the offense rates for each context. The raw data suggests that adding an illegal context results in

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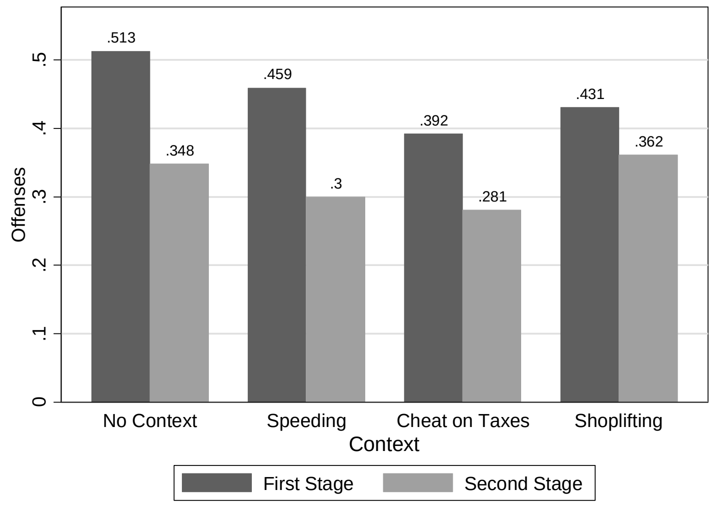
decreasing penalty structures (7,3), and (9,1) do not have significantly different numbers of second stage offenses when subjects face the first fine.

[24] The following pairs are found to have significantly different numbers of second stage offenses conditional on being caught in the first stage: (1,9) and (5,5); (1,9) and (7,3); (1,9) and (9,1); (3,7) and (5,5); (3,7) and (7,3); (3,7) and (9,1); (5,5) and (9,1); and (7,3) and (9,1). In other words, conditional on being caught in the first stage the two increasing penalty structures are not significantly different from one another in the second stage offenses, and (5,5) does not result in significantly more offenses than (7,3).

[25] As noted in the previous footnote, penalty structures (9,1) and (7,3) have significantly higher repeat offense rates than (1,9) and (3,7). However, it is important to remember that fewer subjects have the chance to be a repeat offender in the decreasing penalty scenarios because few subjects choose to offend in the first stage of a decreasing penalty structure.

fewer total offenses in the experiment. Paired Wilcoxon tests reveal significant differences in the offense rate when the decision is described as "taking a chance" as opposed to "driving over the speed limit," or "cheating on your taxes." Thus, we may identify some possible stigma effect of committing criminal behavior as opposed to simply risky behavior.[26] However, there was no significant difference in the offense rate with no context and with the shoplifting context, perhaps because shoplifting is a criminal behavior with which our subject pool is less familiar.

Figure 3. Offense Rates by Context



Overall, the graphs of offense levels and rates suggest that our results are consistent with the theoretical model of Emons (2003); decreasing penalty structures lead to greater levels of deterrence than increasing penalty structures across all contexts.[27] However, there may also be potentially confounding effects of individual characteristics

4.3 Individual-Characteristics and Penalty Structures

In addition to whether the fine structure is increasing or decreasing, individual subject characteristics may play a role in how likley the subjects are to choose to offend. Table 4 provides details on how many offenses subjects commit by gender and risk tolerance. Notice that

[26] See Shoji (2013) and Tadelis (2011) for a discussion of guilt and shame associated with others' perceptions of one's choice in the lab and field.
[27] We repeat our analysis separately for each context and the results remain consistent; decreasing penalty structures result in fewer offenses than increasing penalty structures, regardless of the context. These results are available upon request.

about 5% of the subjects never commit an offense and almost 4% commit 9 or 10 offenses. The average number of offenses commited is 4.0, which is less than the 5 to 8 offenses that theory predicts will be committed. Table 4 also reports that female subjects are significantly more likely than male subjects to commit a lower number of offenses.[28] We also divide our sample into those who are risk averse and those who are not risk averse based on their decisions on the Holt and Laury (2004) lottery choice experiment. Recall that the optimal strategies based on the theory of Emons (2003) do not change for subjects who are risk averse.[29] As the numbers in the table suggest, risk averse subjects commit significantly fewer total offenses than those who are not risk averse.[30] Thus, we include controls for individual-specific traits in the regression analysis we present in the next section.

Table 4. Total Offenses Committed by Gender and Risk Tolerance

Total Offenses	All Subjects	%	Female	%	Male	%	Not Risk Averse	%	Risk Averse	%
0	17	4.64	10	4.93	7	4.29	2	2.47	14	5.02
1	31	8.47	24	11.82	7	4.29	5	6.17	24	8.60
2	55	15.03	38	18.72	17	10.43	6	7.41	49	17.56
3	58	15.85	27	13.30	31	19.02	12	14.81	44	15.77
4	60	16.39	35	17.24	25	15.34	11	13.58	48	17.20
5	47	12.84	26	12.81	21	12.88	16	19.75	31	11.11
6	46	12.30	20	9.85	25	15.34	12	14.81	34	12.19
7	22	6.01	6	2.96	16	9.82	5	6.17	16	5.73
8	18	4.92	7	3.45	11	6.75	7	8.64	11	3.94
9	8	2.19	8	3.94	0	0.00	2	2.47	6	2.15
10	5	1.37	2	0.99	3	1.84	3	3.70	2	0.72
Total	367	100	203	100	163	100	81	100	279	100

[28] The average number of times a female subject offends is 3.78 compared to 4.41 for male subjects. A Wilcoxon test rejects the hypothesis these are equal (p-value = 0.002). One subject did not report gender on the survey, thus the total number of female and male subjects is 366.
[29] If subjects are extremely risk averse, the ranking of strategies changes under penalty structure (5,5). Even for our most risk averse subjects, however, we do not find higher levels of consistency with predicted behaviors for penalty structure (5,5).
[30] Subjects who are not risk averse offend an average of 4.79 times and subjects that are risk averse offend an average of 3.87 times. The p-value for the Wilcoxon test is 0.002. Seven subjects made an irrational decision in the Holt and Laury (2004) experiment by choosing a certain lower payoff in one situation. We were not able to impute a risk tolerance parameter for those subjects, resulting in 360 subjects with risk preference information.

Given that demographic characteristics appear to be correlated with the frequency of offending, we examine the effect of the penalty scheme on deterrence by running an ordered probit of total offenses in a period controlling for the subject's gender, risk aversion, context, presentation order treatment, and an indicator for whether the subject was caught in the first stage. [31,32] Based on these probit results, we calculate the predicted probability that an individual never commits an offense, commits an offense one time, or commits an offense in both stages under a particular penalty structure. These results are presented in Table 5.

Table 5: Predicted Probabilities of Outcomes

Penalty Structure	No Offenses	One Offense	Two Offenses
(1,9)	0.160	0.408	0.431
(3,7)	0.232	0.443	0.325
(5,5)	0.424	0.418	0.158
(7,3)	0.603	0.320	0.077
(9,1)	0.628	0.305	0.067

Individuals are most likely to commit no offenses in the decreasing penalty regime (where there is a higher first stage penalty). On the other hand, increasing penalty structures have the highest predicted rate of subjects committing two offenses (at 43% and 33%), perhaps because individuals who are not caught in the first stage have high incentives to recidivate. Even after controlling for individual characteristics, being caught in the first stage, context, and the order in which the fines were presented, the overall implication of Table 5 is that decreasing penalty structures are far more effective in deterring offenses and are more likely to result in zero offenses than increasing penalty structures.[33]

[31] As described in the experimental design section, subjects saw one of two order treatments in the experiment, starting with the (1,9) penalty structure regime and proceeding to the (9,1) regime (Treatment 1) or the reverse order where subjects saw the (9,1) penalty first (Treatment 2). In considering the effect of order we find that the qualitative comparisons between the different penalty structures within a presentation order treatment are consistent across treatments. That is, there are always more offenses in the (1,9) penalty structure than in the (3,7) penalty structure, regardless of whether (1,9) is seen first or last.

[32] Marginal effects from the ordered probit regression are available upon request. We find that being risk averse increases the likelihood of not offending and decreases the likelihood of offending 1 or 2 times. Male subjects are also significantly less likely to offend zero times, and significantly more likely to offend 1 or 2 times.

[33] The marginal effects of the penalty structures are all negative and significant relative to the baseline penalty structure of (1,9). In addition, we perform pairwise Wald tests of the coefficients on the penalty structures. Each penalty structure is significantly different from the other except for the pair (7,3) and (9,1).

4.4 *Individual-Level Choice to Offend in Each Stage*

While the above sections have shown that a decreasing fine structure reduces the overall number of offenses, we have not examined the impact of fine structures, amongst other things, on the individual choice to commit offenses in each stage. To do so, we run probit regressions on the individual decision of whether or not to offend in each stage.[34] Table 6 presents the marginal effects from the analysis. We control for subject characteristics (male, risk averse), the presentation order treatment, the context, the number of times a subject has offended in previous rounds, the number of times a subject has been caught in previous rounds (excluding the first stage of the current round), and an indicator for whether the subject was caught in the first stage of the particular round. To isolate the effect of the penalty structure, in Model 1 we include controls for whether the decision is a second stage decision and an indicator for each penalty structure.[35] Errors are clustered at the subject level to account for the potential correlation across the 10 individual decisions.

The results at the individual level confirm the aggregate results; the coefficients on the decreasing fine structures (7,3) and (9,1) are significantly different from the omitted category penalty structure (1,9).[36] By disaggregating the data to the individual level decisions, we also observe some phenomena that we did not observe in the aggregated data. First, subjects who offend more often ("Number of Offenses Committed") are almost 9 percentage points more likely to continue to offend in the particular stage. Second, subjects who initially observe the (9,1) treatment are 5.5 percentage points more inclined to offend in any decision relative to those who saw the (1,9) treatment first. Moreover, the average marginal effect of an additional instance of being caught in previous penalty structures decreases the likelihood of offending by slightly more than 2 percentage points, even though being caught under a previous penalty structure has no impact on the current period's potential payoffs. This is suggestive of a specific deterrence effect; subjects respond to previous punishment experience even when that previous punishment is not

[34] Note that when we look at individual decisions, each subject makes 10 decisions, thus the total number of observations is now 3590 (359 individuals with non-missing demographic information times 10 decision per subject).
[35] Model 1 also includes an interaction term for presentation order treatment and penalty structure.
[36] Consistent with our previous results, Wald tests show the coefficients on penalty structures are all significantly different from one another with the exception of the pair (7,3) and (9,1).

affecting the current cost of offending. Lastly, we find that being caught in the first stage reduces the probability of offending in the second stage by about 15 percentage points (in addition to the 16 percentage point reduction in probability of offending that exists for the average second stage decision).

Model 2 addresses the issue of the penalty structure in a slightly different way. Instead of including indicator variables for each penalty structure, we include an indicator variable to capture whether subjects are making decisions under an increasing fine scheme. We also include a variable to capture the separate effect of the specific fine faced by the subject. The qualitative results from Model 1 hold, with two exceptions. The coefficients on the presentation order treatment variable and the indicator variable for being caught in the first stage change signs and are no longer significant. Model 2 reveals that, independent of the specific fine faced for any given decision, being in an increasing penalty structure increases the probability a subjects will commit an offense by a little more than 5%. This provides additional evidence that subjects take the two-stage nature of the decision into account when making decisions and are less deterred by increasing penalty structures.

Table 6: Marginal Effects

	Dependent Variable = Probability of Offending	
	Model 1	Model 2
Male	0.0360**	0.0495**
	(0.016)	(0.021)
Risk averse	-0.0568***	-0.0689***
	(0.018)	(0.025)
Number of offenses committed	0.0863***	0.0295***
	(0.007)	(0.007)
Presentation order treatment: (9,1) first	0.0551***	-0.0043
	(0.016)	(0.021)
Second stage decision	-0.1606***	
	(0.018)	
Penalty Structure (3,7)	-0.0908***	
	(0.018)	
Penalty Structure (5,5)	-0.3030***	
	(0.021)	
Penalty Structure (7,3)	-0.4147***	
	(0.021)	
Penalty Structure (9,1)	-0.4195***	
	(0.023)	
"Speeding" context	-0.0255	-0.0334
	(0.021)	(0.030)
"Cheating on Taxes" context	-0.0535**	-0.0792***
	(0.023)	(0.030)
"Shoplifting" context	-0.0214	-0.0319
	(0.021)	(0.029)
Number of times caught in all previous periods	-0.0245*	-0.0334**
	(0.014)	(0.014)
Caught in first stage of current period	-0.1523***	0.0023
	(0.034)	(0.030)
Fine faced in current period		-0.0631***
		(0.003)
Increasing penalty structure		0.0540***
		(0.020)
Number of Observations	3590	3590

* p<0.1, ** p<0.05, *** p<0.01. Note: All variables are indicator variables except number of times caught, number of offenses, number of times caught in all previous periods and fine faced in current period. Standard errors are clustered at the subject level.

5. Conclusion

Escalating penalty structures that are intended to deter proscribed behavior are commonplace in penal codes, despite little theoretical or empirical support. There is a large literature on optimal law enforcement following the pioneering work of Becker (1968). Emons (2003, 2004) presents multi-period models of criminal enforcement based on the standard economic approach of Becker and finds that decreasing penalties are optimal. Some multi-period models support the use of escalating penalties, but only in special circumstances.

To our knowledge, we present the first experimental study to focus on whether increasing or decreasing penalty schemes are better at deterring risky behavior. Thus, we chose the basic model of Emons (2003) as the starting point for our design. As is standard in this literature, Emons (2003) models the law enforcer's joint choice of the probability of detection and the penalty if detected. A number of experimental papers have examined the tradeoff between the probability of detection and the penalty if detected in a repeated one-shot decision.[37] A general finding from this literature is that there are complicated interactions between the certainty and severity of punishment. For this reason, we fix the probability of detection and examine the effect of the severity of punishment in a two-period model of criminal enforcement.

Consistent with the Emons (2003) model, we find that decreasing, rather than increasing, sanction schemes provide better deterrence in our repeated decision making situation. This result makes the widespread use of increasing sanctions puzzling. The relative simplicity of the model might explain why the theoretical prediction and observed behavior in the lab are different from the increasing sanctions we observe in most penal codes. For example, as has been shown in the theoretical literature, the fact that crimes can be committed accidentally may explain the prevalence of increasing sanction schemes. Likewise, when agents have different propensities to offend, escalating penalties may be useful as a screening device. Nevertheless, in situations where our model applies (e.g. fraud, insider trading, cartels, mafias, etc.), the use of harsh penalties for the first crime seems to be warranted.

We explore some behavioral features of the decision making process that are not predicted by the rational decision-making model of Emons (2003). We observe greater offense levels when

[37] See, for example, Anderson and Stafford (2003), Harel and Sega (1999), DeAngelo and Charness (2012), Friesen (2012) and Schildberg-Horisch and Strassmair (2012).

subjects are male, less risk averse, and have committed offenses in previous rounds. We also observe that being caught under previous penalty structures has a small deterrence effect in the current penalty structure, even though both the probability of being caught and the fine are independent of previous rounds. Even after controlling for the specific fine a subject faces, we find that the probability of committing an offense is higher under an increasing penalty regime. When we examine the subject responses to current fines faced, we also find evidence that subjects treat the choice to offend in each stage as part of a two-stage interrelated decision (i.e., subjects consider the full penalty structure of the period) and do not respond solely to the amount of the fine. A natural extension of this study is to incorporate some of the more complicated theoretical assumptions from this literature into our experimental design to test the predictive power of a model that supports the use of escalating penalties.

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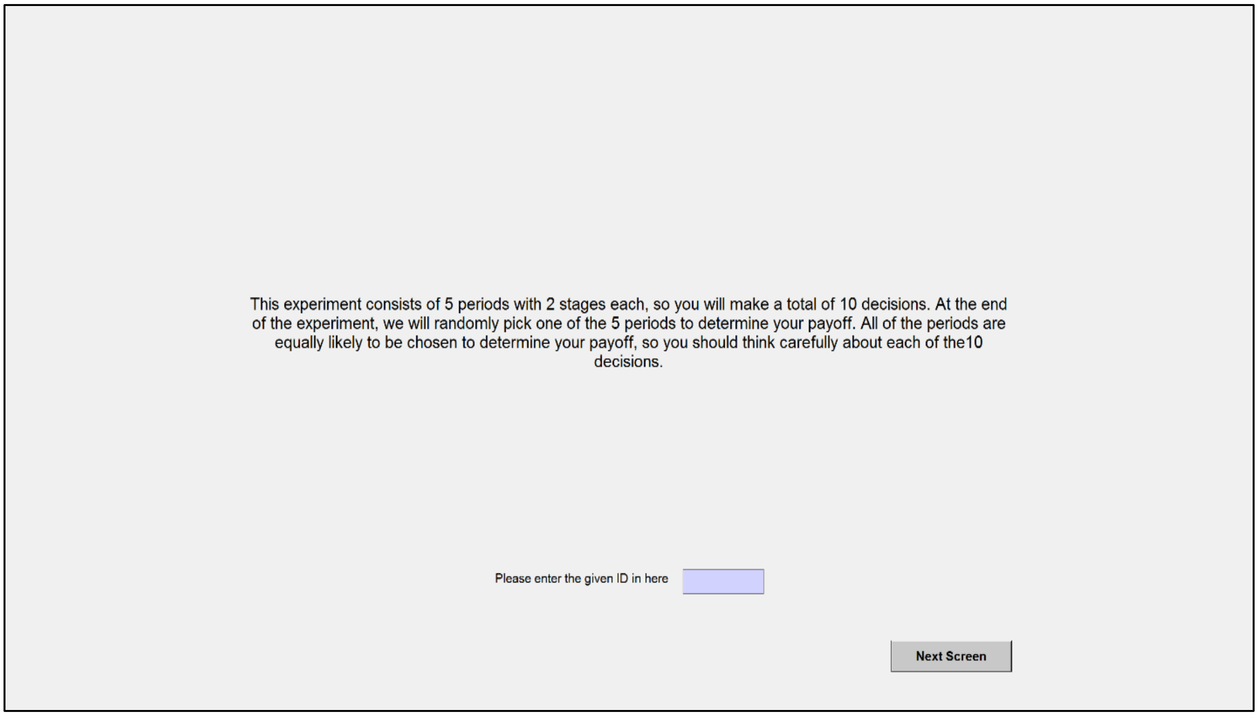
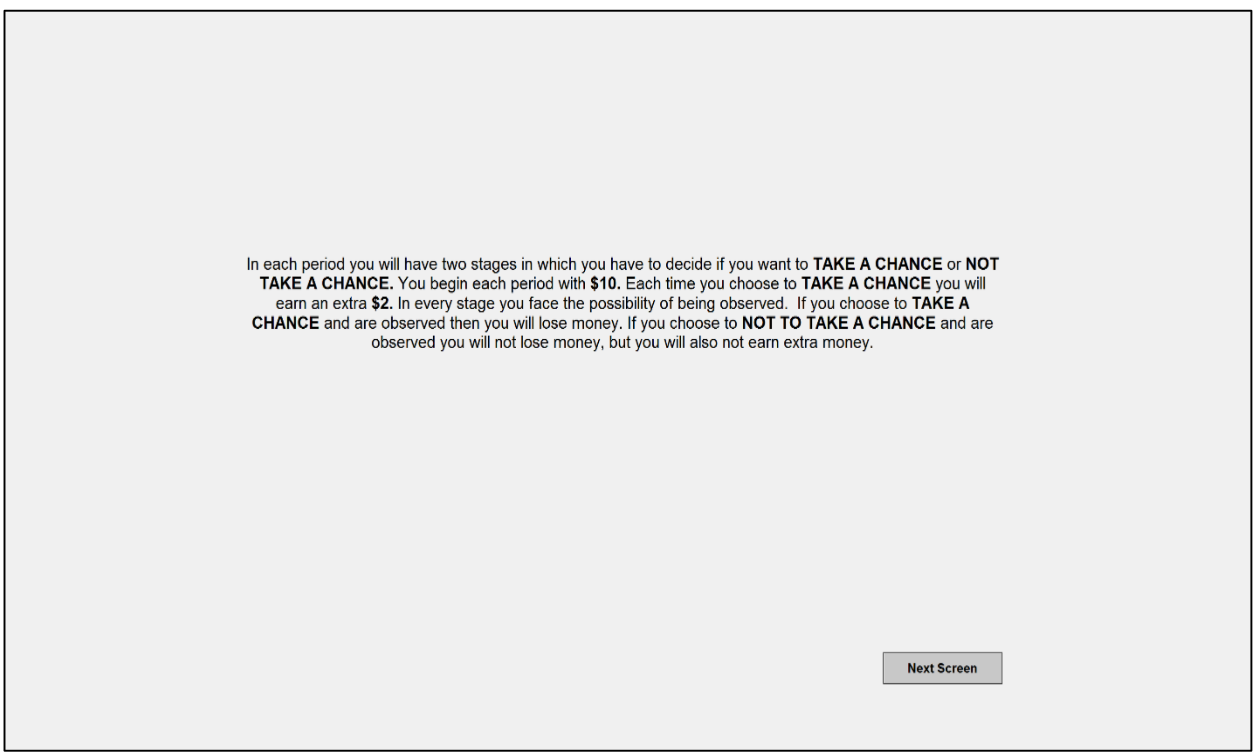
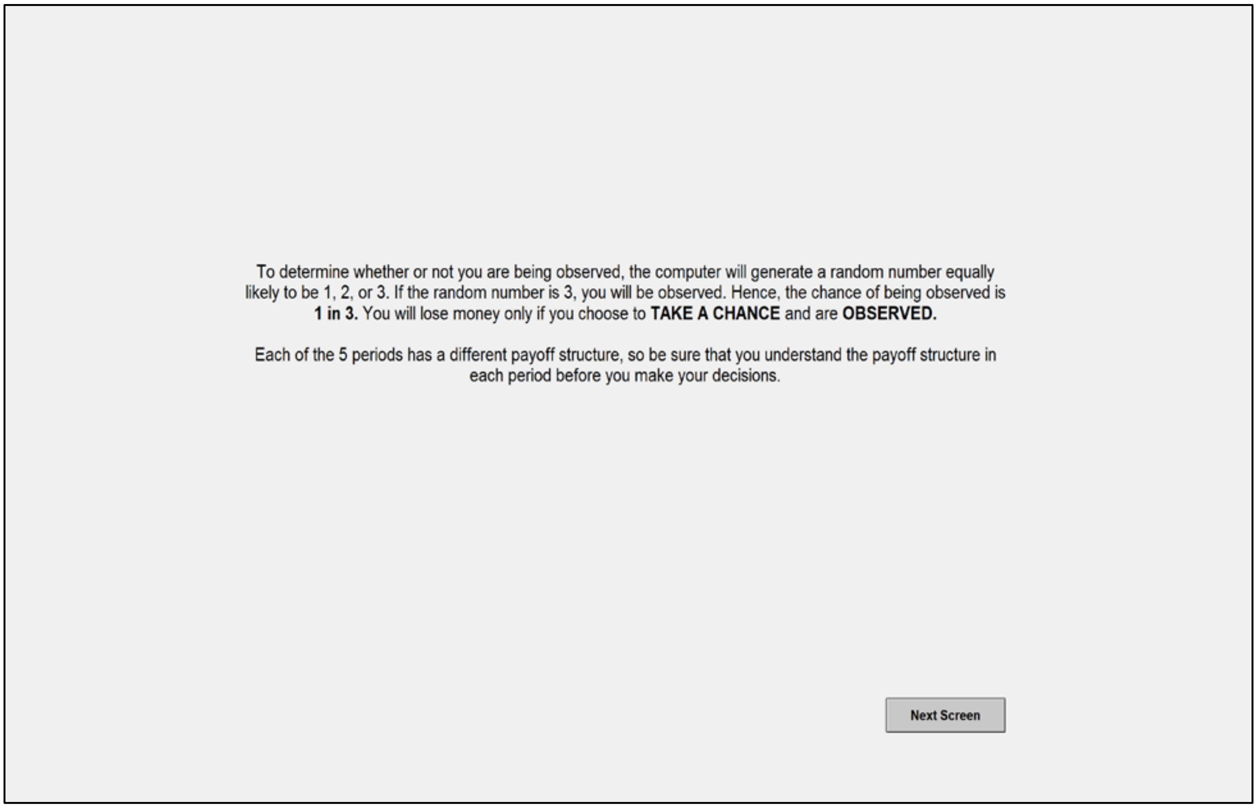
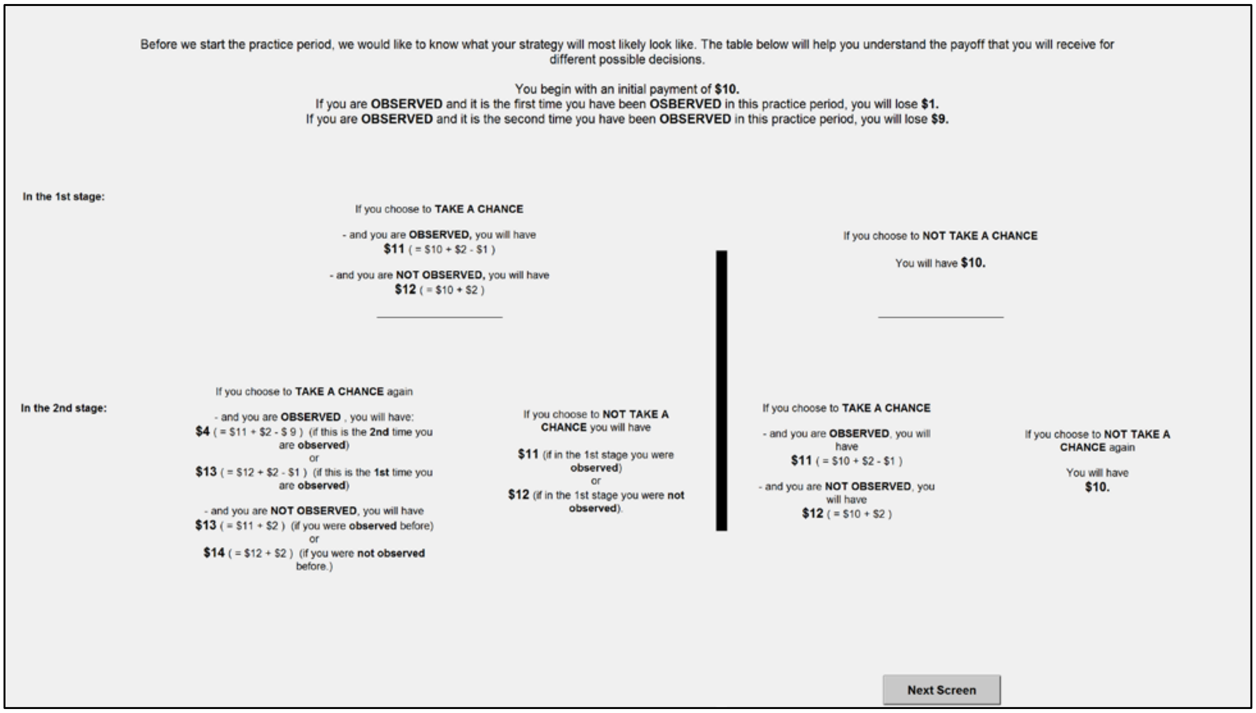
Appendix A: Screenshots of Experiment



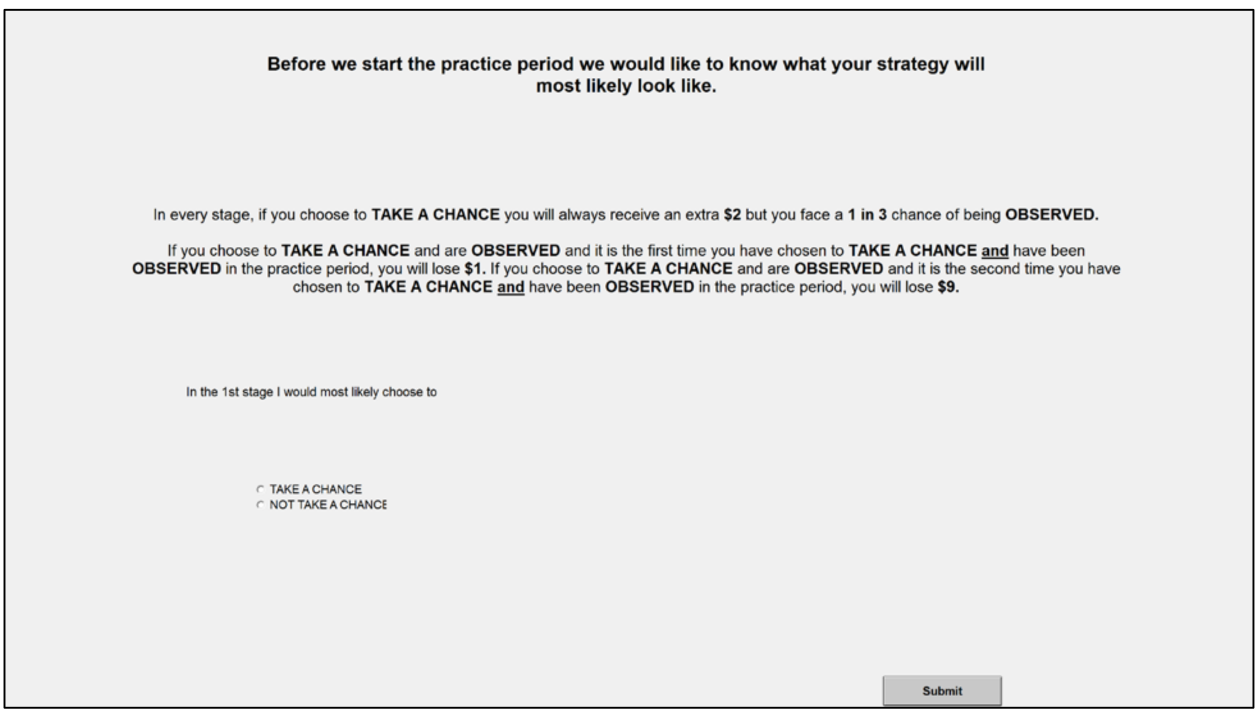



To determine whether or not you are being observed, the computer will generate a random number equally likely to be 1, 2, or 3. If the random number is 3, you will be observed. Hence, the chance of being observed is **1 in 3.** You will lose money only if you choose to **TAKE A CHANCE** and are **OBSERVED.**
Each of the 5 periods has a different payoff structure, so be sure that you understand the payoff structure in each period before you make your decisions.
Next Screen

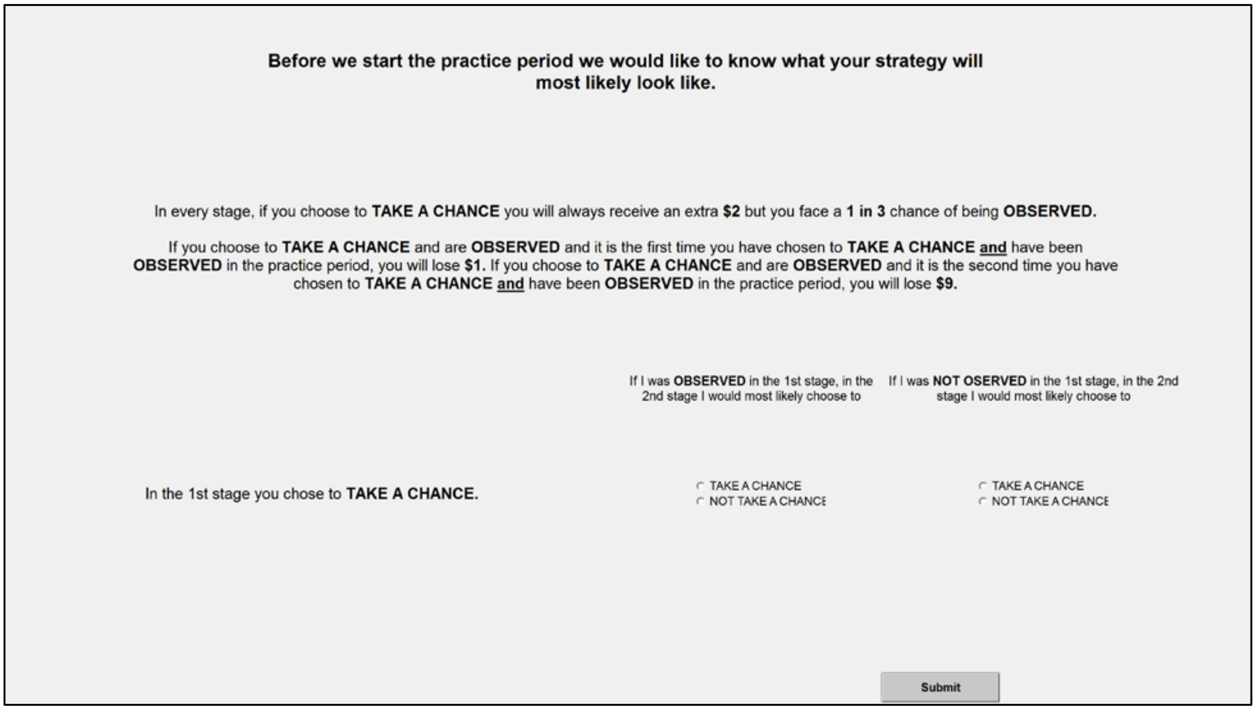

Now you will play a practice period to help you understand how the game works. This practice period will have 2 stages just like the 5 actual periods you will play in a moment. Because this is a practice period, your decisions in this period will **NOT** affect your actual earnings today.
Remember: You begin with an initial payment of **$10.**
Every time you choose to **TAKE A CHANCE** you will receive an extra **$2,** but you face a **1 in 3** chance of being **OBSERVED.** If you choose to **TAKE A CHANCE** and are **OBSERVED,** then you will lose money as described on the next screen. If you choose to **NOT TAKE A CHANCE,** and you are **OBSERVED,** then you will not lose money, but you will also not earn extra money.
Next Screen



Before we start the practice period, we would like to know what your strategy will most likely look like. The table below will help you understand the payoff that you will receive for different possible decisions.
You begin with an initial payment of $10.
If you are OBSERVED and it is the first time you have been OSBERVED in this practice period, you will lose $1.
If you are OBSERVED and it is the second time you have been OBSERVED in this practice period, you will lose $9.
In the 1st stage:
If you choose to TAKE A CHANCE
- and you are OBSERVED, you will have $11 (= $10 + $2 - $1)
- and you are NOT OBSERVED, you will have $12 (= $10 + $2)
If you choose to NOT TAKE A CHANCE
You will have $10.
In the 2nd stage:
If you choose to TAKE A CHANCE again
- and you are OBSERVED , you will have:
$4 (= $11 + $2 - $ 9) (if this is the 2nd time you are observed)
or
$13 (= $12 + $2 - $1) (if this is the 1st time you are observed)
- and you are NOT OBSERVED, you will have
$13 (= $11 + $2) (if you were observed before)
or
$14 (= $12 + $2) (if you were not observed before.)
If you choose to NOT TAKE A CHANCE you will have
$11 (if in the 1st stage you were observed)
or
$12 (if in the 1st stage you were not observed).
If you choose to TAKE A CHANCE
- and you are OBSERVED, you will have $11 (= $10 + $2 - $1)
- and you are NOT OBSERVED, you will have $12 (= $10 + $2)
If you choose to NOT TAKE A CHANCE again
You will have $10.
Next Screen



Before we start the practice period we would like to know what your strategy will most likely look like.
In every stage, if you choose to TAKE A CHANCE you will always receive an extra $2 but you face a 1 in 3 chance of being OBSERVED.
If you choose to TAKE A CHANCE and are OBSERVED and it is the first time you have chosen to TAKE A CHANCE and have been OBSERVED in the practice period, you will lose $1. If you choose to TAKE A CHANCE and are OBSERVED and it is the second time you have chosen to TAKE A CHANCE and have been OBSERVED in the practice period, you will lose $9.
In the 1st stage I would most likely choose to
TAKE A CHANCE
NOT TAKE A CHANCE
Submit



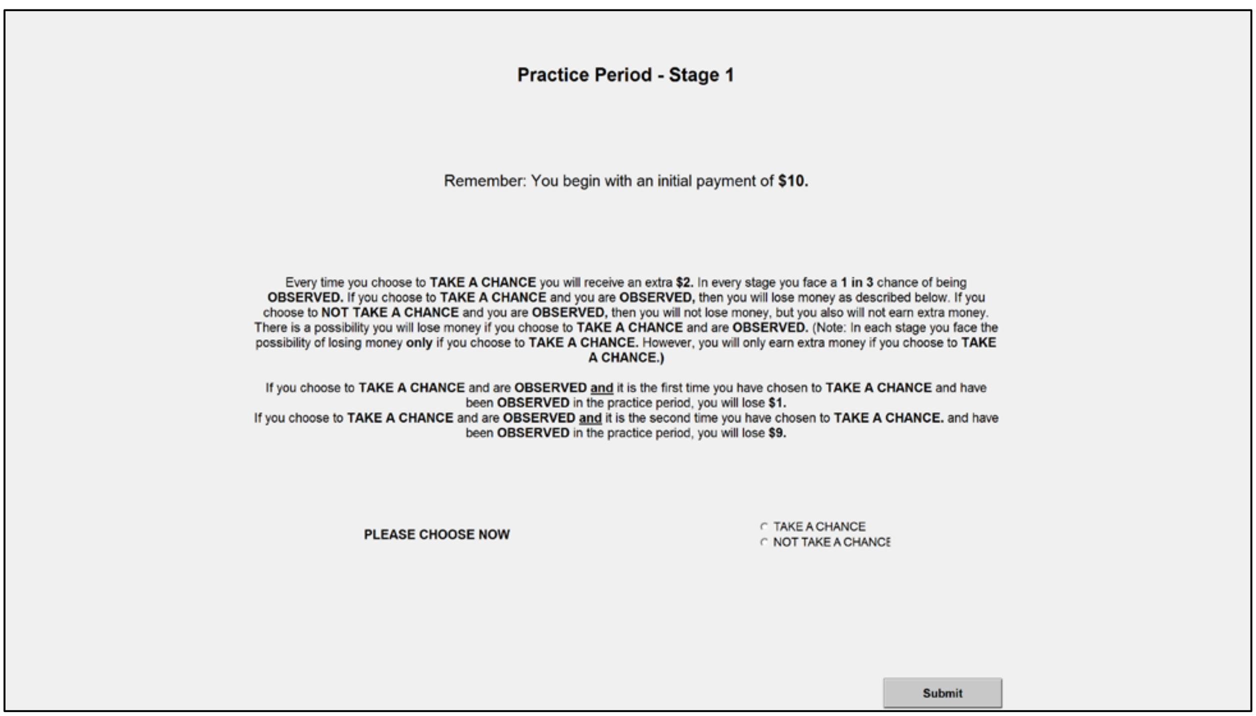
Before we start the practice period we would like to know what your strategy will most likely look like.

In every stage, if you choose to **TAKE A CHANCE** you will always receive an extra **$2** but you face a **1 in 3** chance of being **OBSERVED.**

If you choose to **TAKE A CHANCE** and are **OBSERVED** and it is the first time you have chosen to **TAKE A CHANCE and** have been **OBSERVED** in the practice period, you will lose **$1.** If you choose to **TAKE A CHANCE** and are **OBSERVED** and it is the second time you have chosen to **TAKE A CHANCE and** have been **OBSERVED** in the practice period, you will lose **$9.**

	If I was **OBSERVED** in the 1st stage, in the 2nd stage I would most likely choose to	If I was **NOT OSERVED** in the 1st stage, in the 2nd stage I would most likely choose to
In the 1st stage you chose to **TAKE A CHANCE.**	TAKE A CHANCE NOT TAKE A CHANCE	TAKE A CHANCE NOT TAKE A CHANCE

Submit



Practice Period - Stage 1

Remember: You begin with an initial payment of **$10.**

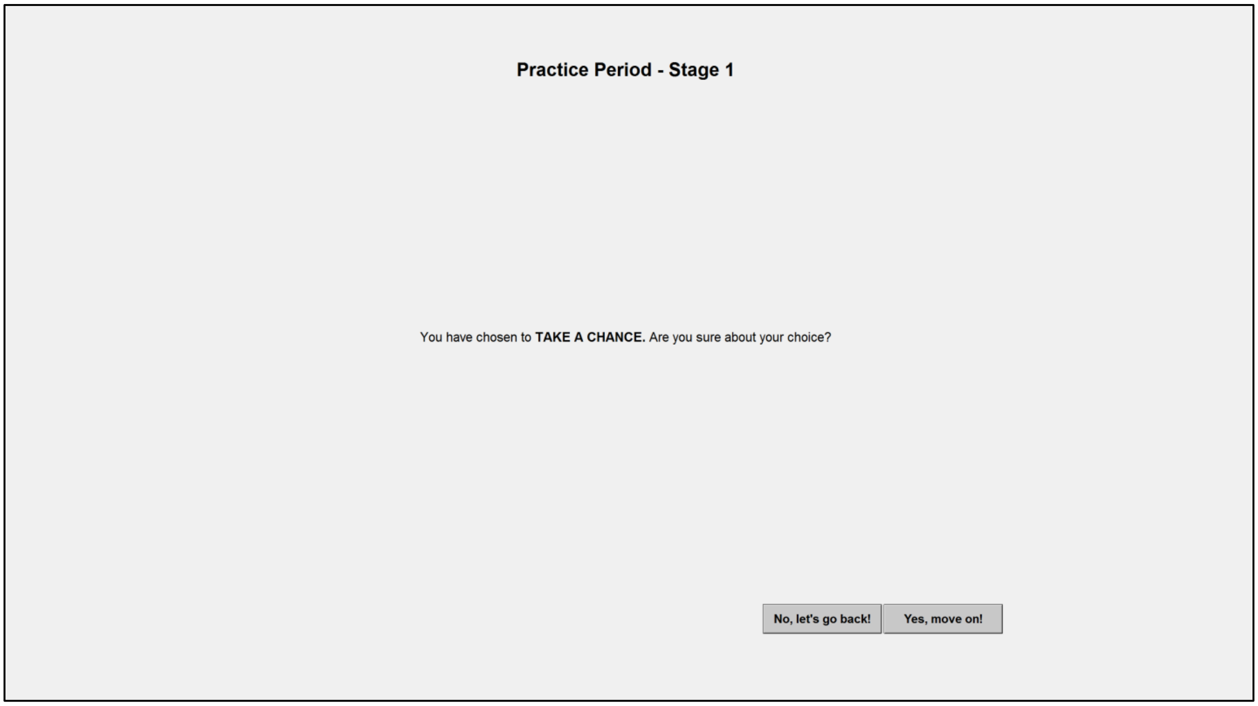
Every time you choose to **TAKE A CHANCE** you will receive an extra **$2.** In every stage you face a **1 in 3** chance of being **OBSERVED.** If you choose to **TAKE A CHANCE** and you are **OBSERVED,** then you will lose money as described below. If you choose to **NOT TAKE A CHANCE** and you are **OBSERVED,** then you will not lose money, but you also will not earn extra money. There is a possibility you will lose money if you choose to **TAKE A CHANCE** and are **OBSERVED.** (Note: In each stage you face the possibility of losing money **only** if you choose to **TAKE A CHANCE.** However, you will only earn extra money if you choose to **TAKE A CHANCE.)**

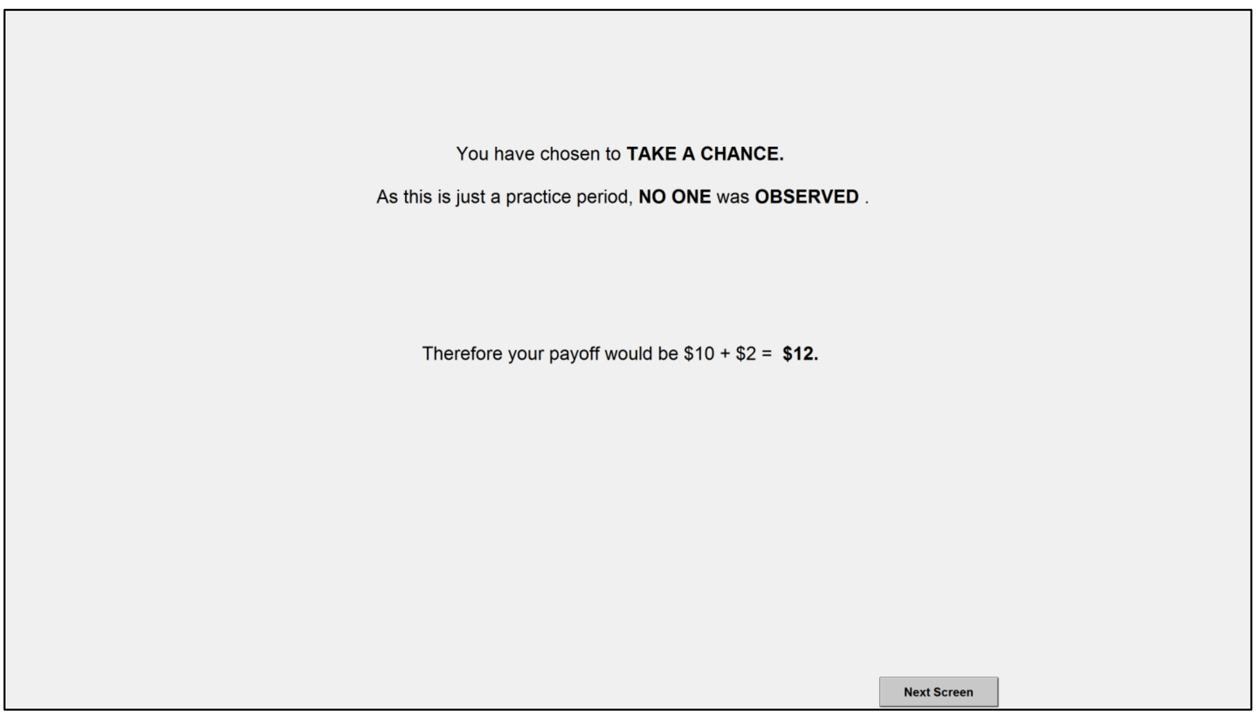
If you choose to **TAKE A CHANCE** and are **OBSERVED and** it is the first time you have chosen to **TAKE A CHANCE** and have been **OBSERVED** in the practice period, you will lose **$1.**
If you choose to **TAKE A CHANCE** and are **OBSERVED and** it is the second time you have chosen to **TAKE A CHANCE.** and have been **OBSERVED** in the practice period, you will lose **$9.**

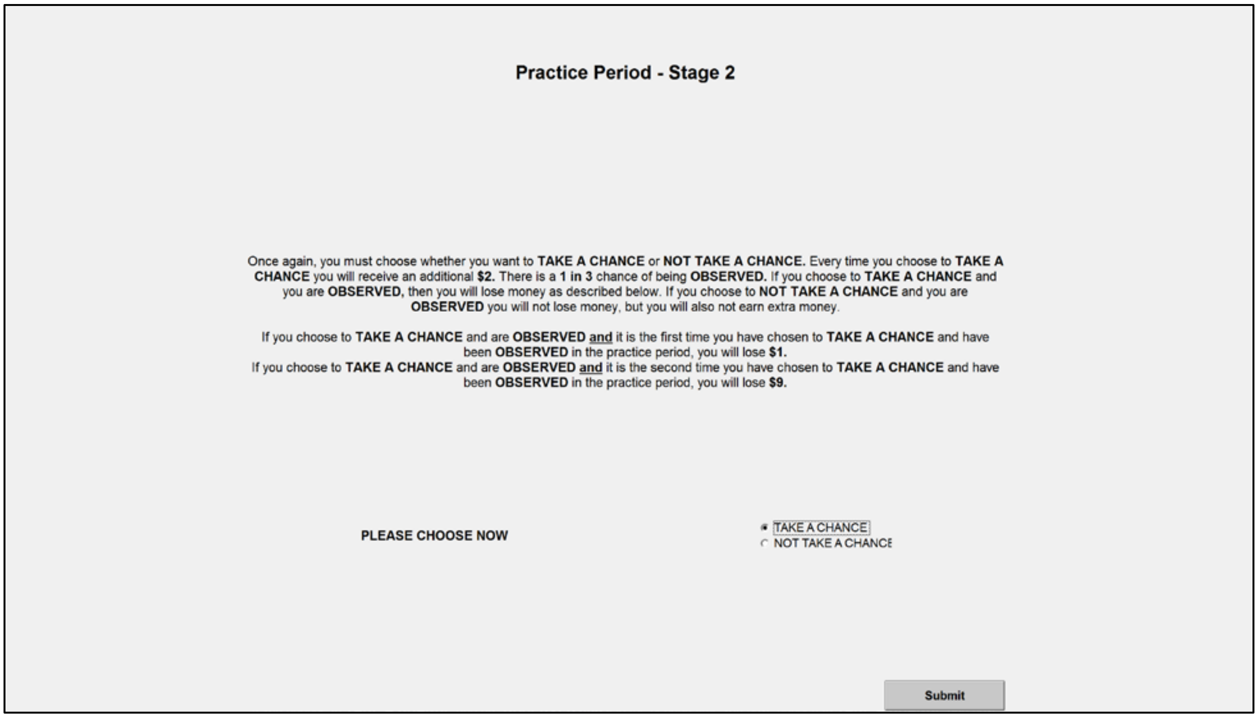
PLEASE CHOOSE NOW

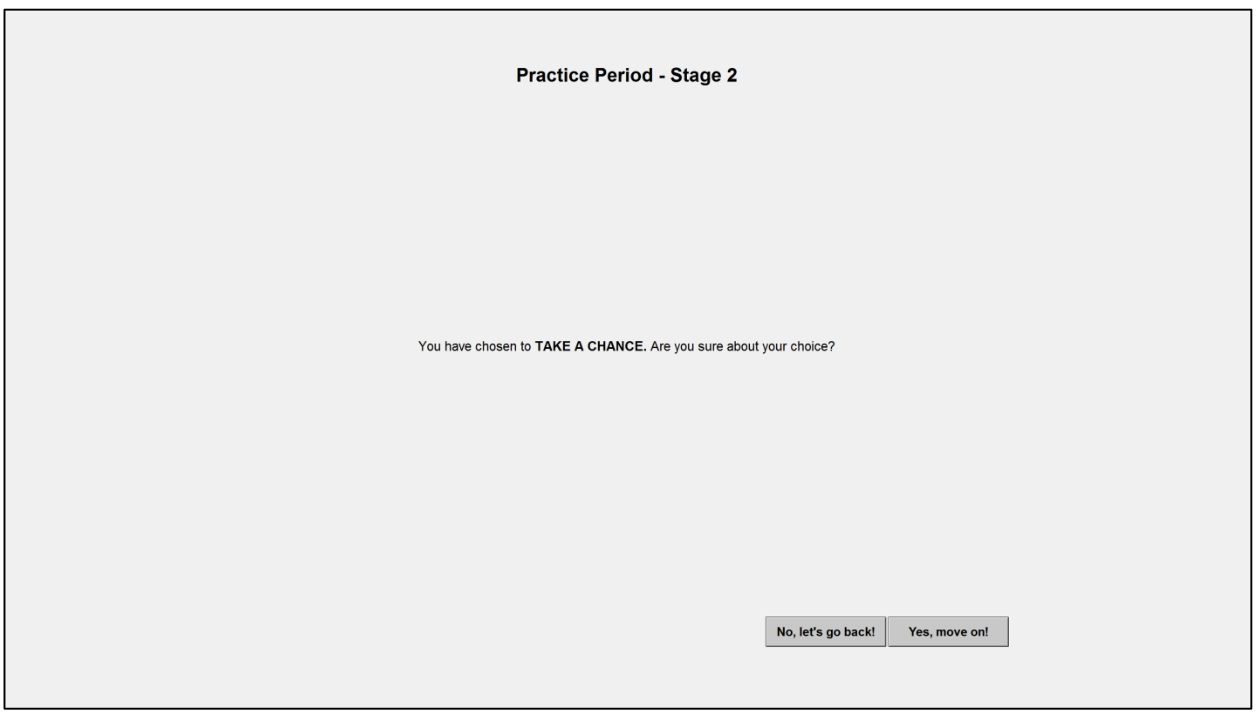
TAKE A CHANCE
NOT TAKE A CHANCE

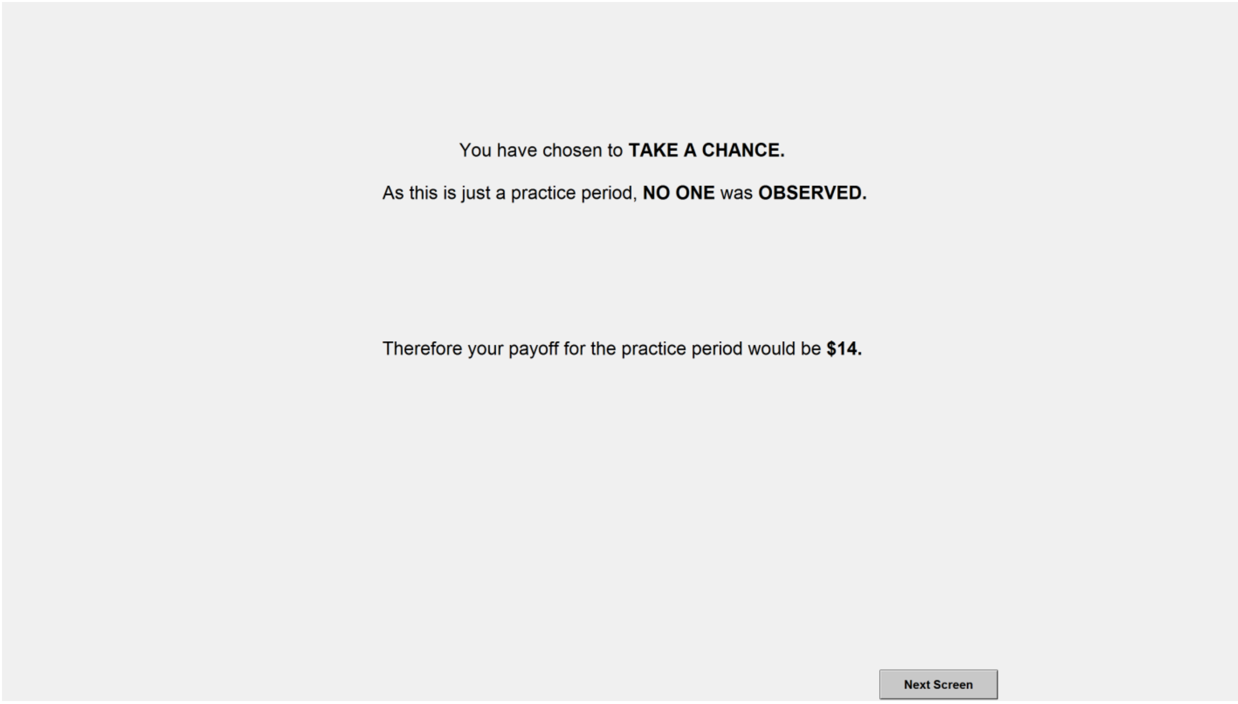
Submit

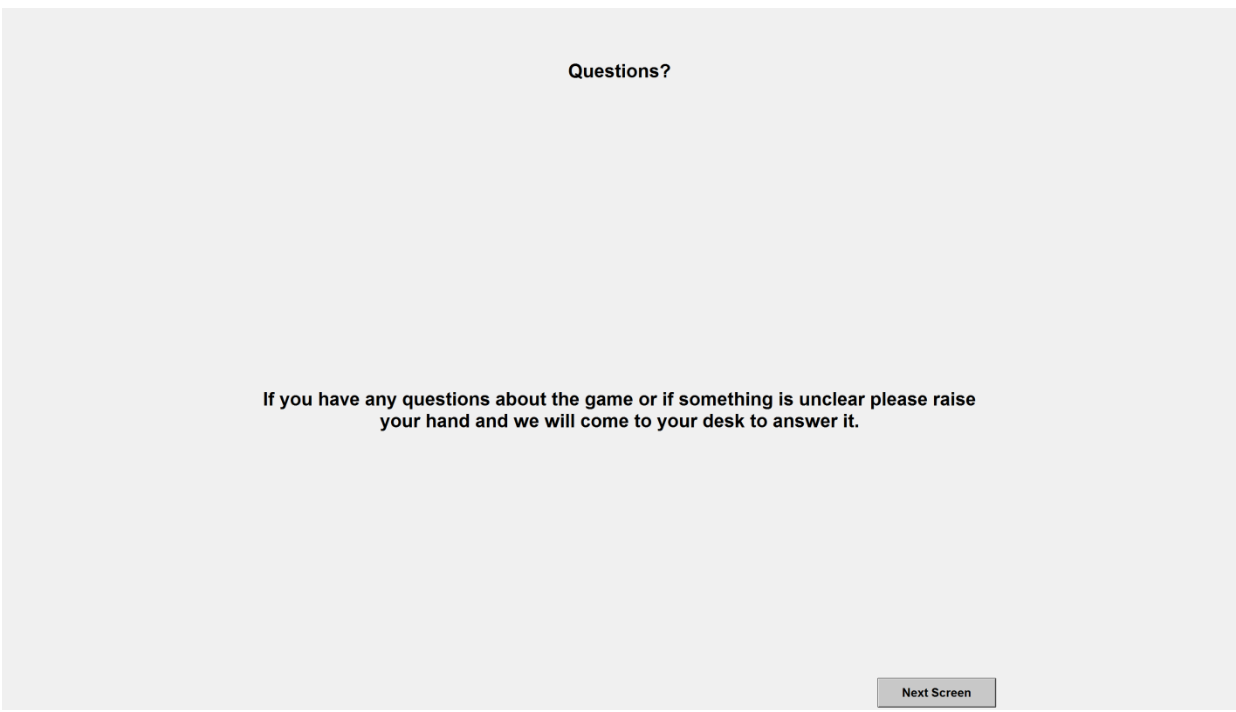

Practice Period - Stage 1
You have chosen to **TAKE A CHANCE.** Are you sure about your choice?
No, let's go back!
Yes, move on!

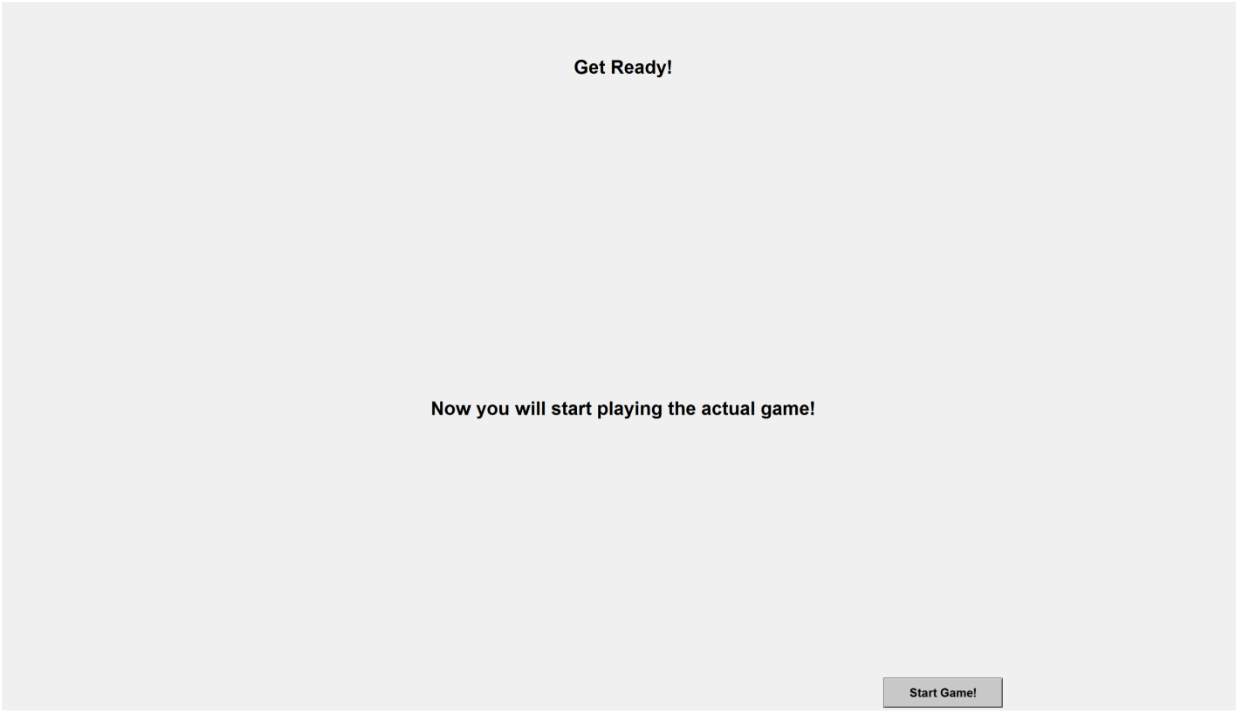

You have chosen to **TAKE A CHANCE.**
As this is just a practice period, **NO ONE** was **OBSERVED** .
Therefore your payoff would be $10 + $2 = **$12.**
Next Screen

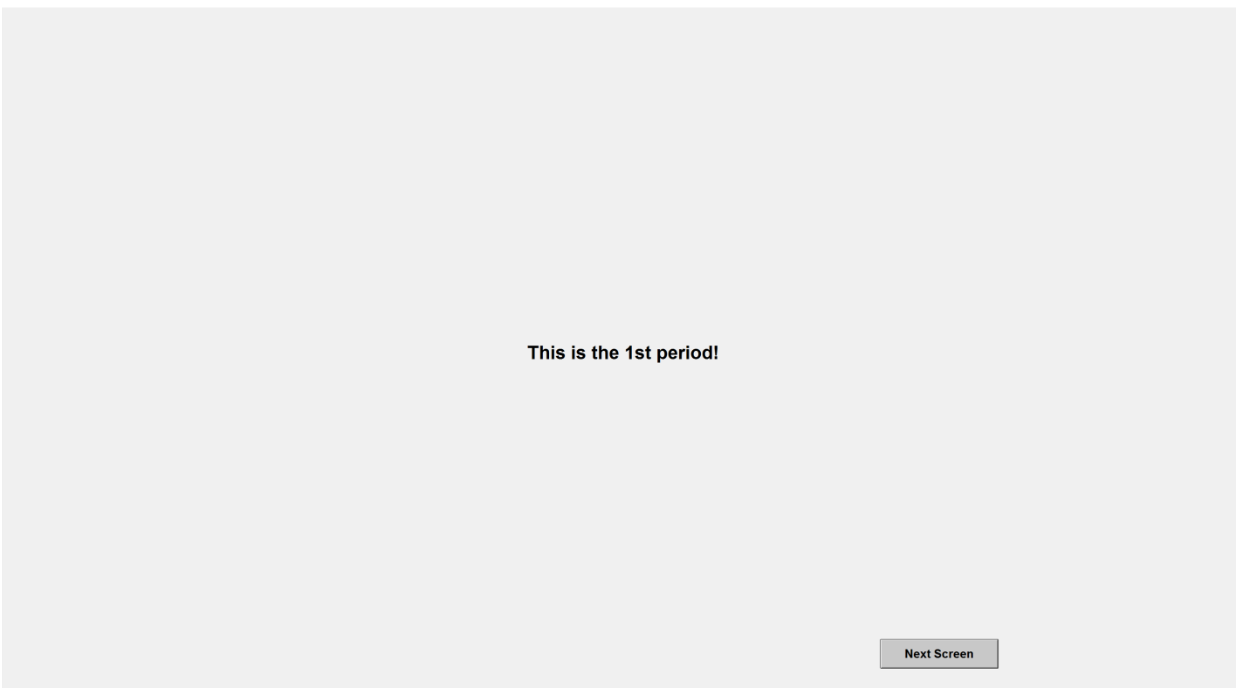

Practice Period - Stage 2
Once again, you must choose whether you want to TAKE A CHANCE or NOT TAKE A CHANCE. Every time you choose to TAKE A CHANCE you will receive an additional $2. There is a 1 in 3 chance of being OBSERVED. If you choose to TAKE A CHANCE and you are OBSERVED, then you will lose money as described below. If you choose to NOT TAKE A CHANCE and you are OBSERVED you will not lose money, but you will also not earn extra money.
If you choose to TAKE A CHANCE and are OBSERVED and it is the first time you have chosen to TAKE A CHANCE and have been OBSERVED in the practice period, you will lose $1.
If you choose to TAKE A CHANCE and are OBSERVED and it is the second time you have chosen to TAKE A CHANCE and have been OBSERVED in the practice period, you will lose $9.
PLEASE CHOOSE NOW
TAKE A CHANCE
NOT TAKE A CHANCE
Submit

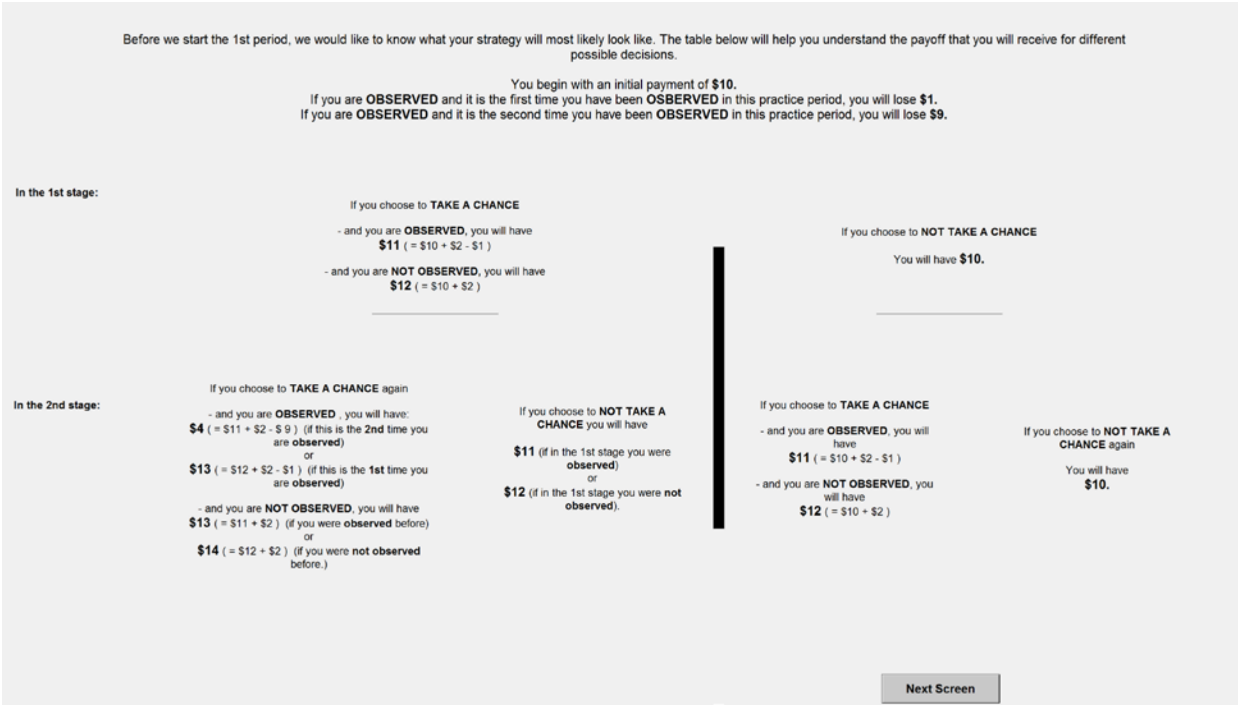

Practice Period - Stage 2
You have chosen to TAKE A CHANCE. Are you sure about your choice?
No, let's go back!
Yes, move on!


You have chosen to TAKE A CHANCE.
As this is just a practice period, NO ONE was OBSERVED.
Therefore your payoff for the practice period would be $14.
Next Screen

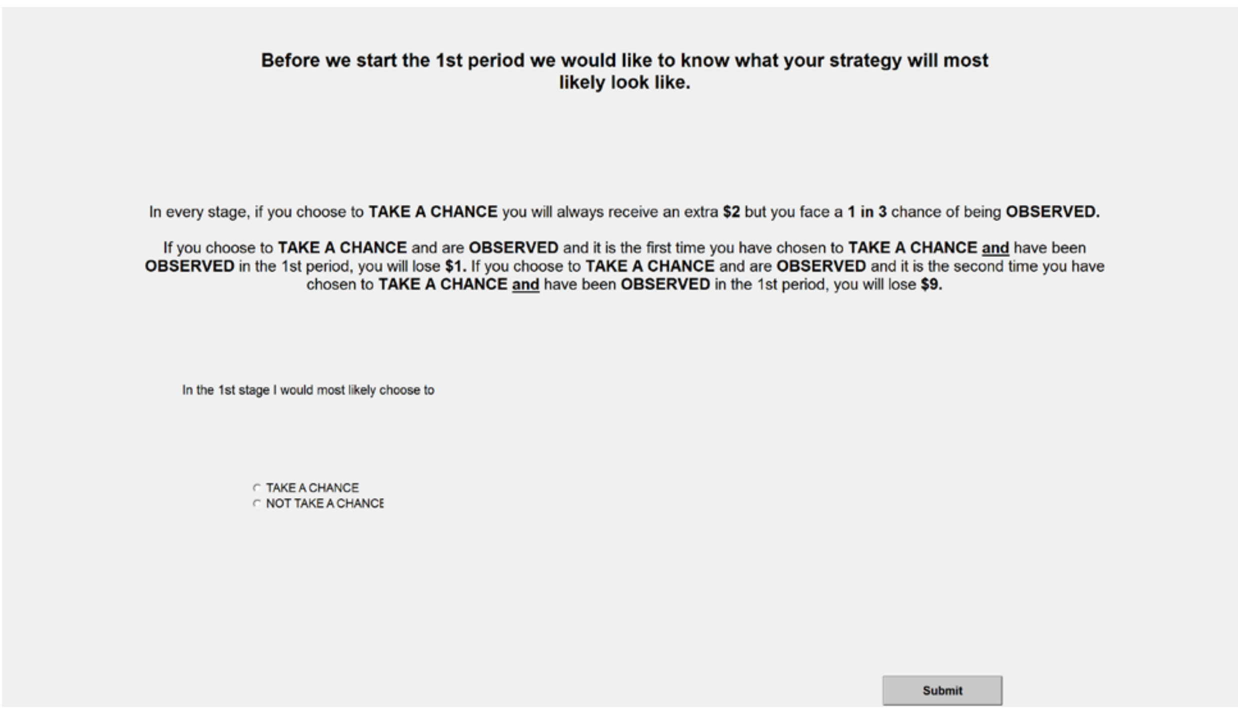

Questions?
If you have any questions about the game or if something is unclear please raise your hand and we will come to your desk to answer it.
Next Screen


Get Ready!
Now you will start playing the actual game!
Start Game!

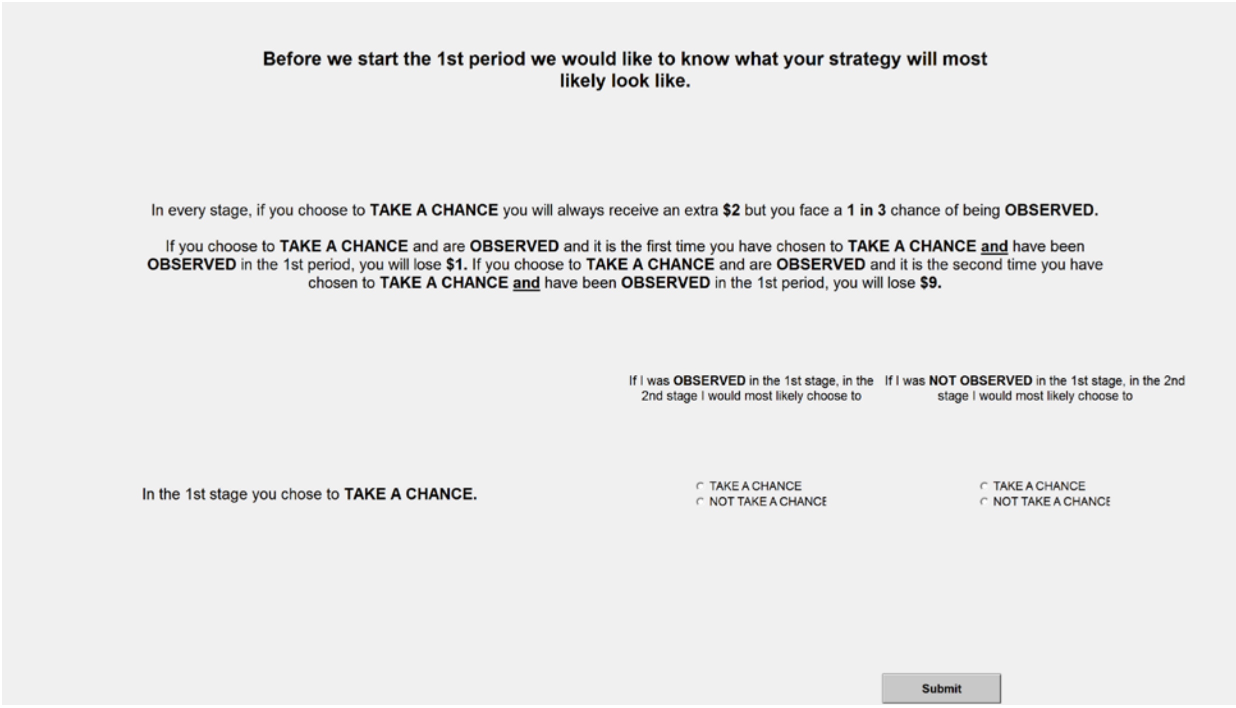

This is the 1st period!
Next Screen



Before we start the 1st period, we would like to know what your strategy will most likely look like. The table below will help you understand the payoff that you will receive for different possible decisions.
You begin with an initial payment of **$10.**
If you are **OBSERVED** and it is the first time you have been **OSBERVED** in this practice period, you will lose **$1.**
If you are **OBSERVED** and it is the second time you have been **OBSERVED** in this practice period, you will lose **$9.**
In the 1st stage:
If you choose to **TAKE A CHANCE**
- and you are **OBSERVED,** you will have **$11** (= $10 + $2 - $1)
- and you are **NOT OBSERVED,** you will have **$12** (= $10 + $2)
If you choose to **NOT TAKE A CHANCE**
You will have **$10.**
In the 2nd stage:
If you choose to **TAKE A CHANCE** again
- and you are **OBSERVED** , you will have: **$4** (= $11 + $2 - $ 9) (if this is the **2nd** time you are **observed**) or **$13** (= $12 + $2 - $1) (if this is the **1st** time you are **observed**)
- and you are **NOT OBSERVED**, you will have **$13** (= $11 + $2) (if you were **observed** before) or **$14** (= $12 + $2) (if you were **not observed** before.)
If you choose to **NOT TAKE A CHANCE** you will have **$11** (if in the 1st stage you were **observed**) or **$12** (if in the 1st stage you were **not observed**).
If you choose to **TAKE A CHANCE**
- and you are **OBSERVED**, you will have **$11** (= $10 + $2 - $1)
- and you are **NOT OBSERVED**, you will have **$12** (= $10 + $2)
If you choose to **NOT TAKE A CHANCE** again
You will have **$10.**
Next Screen



Before we start the 1st period we would like to know what your strategy will most likely look like.
In every stage, if you choose to **TAKE A CHANCE** you will always receive an extra **$2** but you face a **1 in 3** chance of being **OBSERVED.**
If you choose to **TAKE A CHANCE** and are **OBSERVED** and it is the first time you have chosen to **TAKE A CHANCE** **and** have been **OBSERVED** in the 1st period, you will lose **$1.** If you choose to **TAKE A CHANCE** and are **OBSERVED** and it is the second time you have chosen to **TAKE A CHANCE** **and** have been **OBSERVED** in the 1st period, you will lose **$9.**
In the 1st stage I would most likely choose to
TAKE A CHANCE
NOT TAKE A CHANCE
Submit



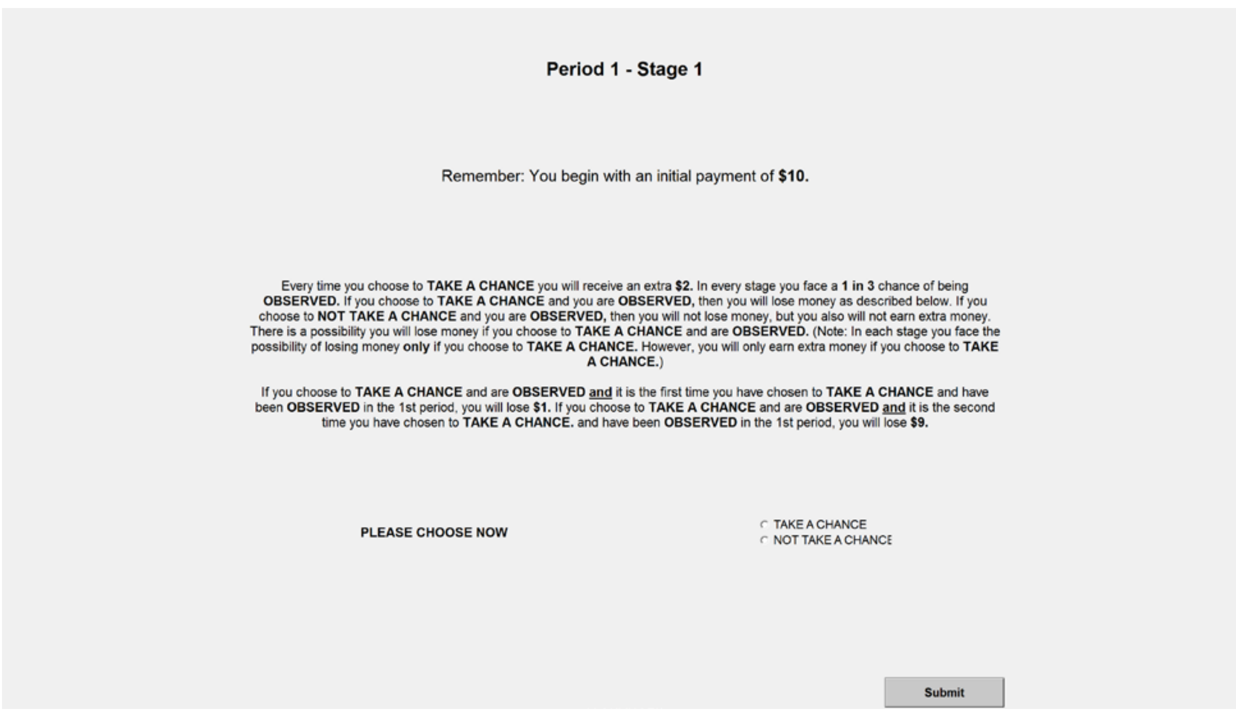
Before we start the 1st period we would like to know what your strategy will most likely look like.

In every stage, if you choose to **TAKE A CHANCE** you will always receive an extra **$2** but you face a **1 in 3** chance of being **OBSERVED.**

If you choose to **TAKE A CHANCE** and are **OBSERVED** and it is the first time you have chosen to **TAKE A CHANCE** **<u>and</u>** have been **OBSERVED** in the 1st period, you will lose **$1.** If you choose to **TAKE A CHANCE** and are **OBSERVED** and it is the second time you have chosen to **TAKE A CHANCE** **<u>and</u>** have been **OBSERVED** in the 1st period, you will lose **$9.**

	If I was **OBSERVED** in the 1st stage, in the 2nd stage I would most likely choose to	If I was **NOT OBSERVED** in the 1st stage, in the 2nd stage I would most likely choose to
In the 1st stage you chose to **TAKE A CHANCE.**	TAKE A CHANCE NOT TAKE A CHANCE	TAKE A CHANCE NOT TAKE A CHANCE

Submit



Period 1 - Stage 1

Remember: You begin with an initial payment of **$10.**

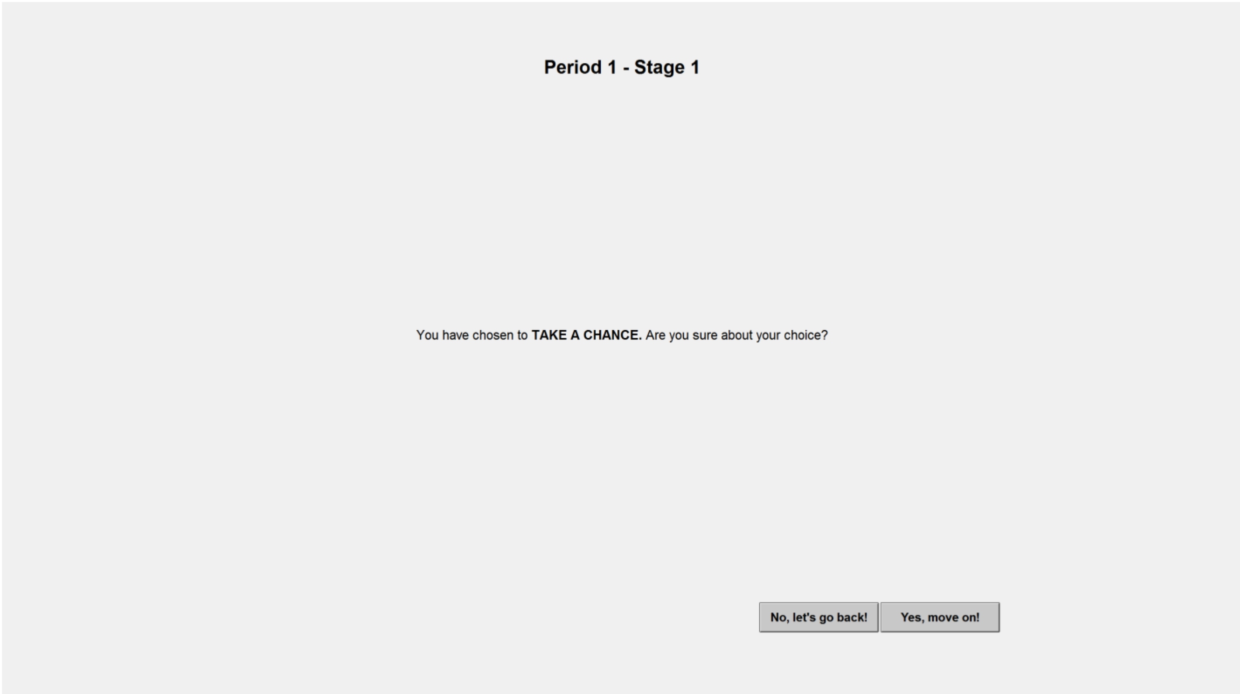
Every time you choose to **TAKE A CHANCE** you will receive an extra **$2.** In every stage you face a **1 in 3** chance of being **OBSERVED.** If you choose to **TAKE A CHANCE** and you are **OBSERVED,** then you will lose money as described below. If you choose to **NOT TAKE A CHANCE** and you are **OBSERVED,** then you will not lose money, but you also will not earn extra money. There is a possibility you will lose money if you choose to **TAKE A CHANCE** and are **OBSERVED.** (Note: In each stage you face the possibility of losing money **only** if you choose to **TAKE A CHANCE.** However, you will only earn extra money if you choose to **TAKE A CHANCE.**)

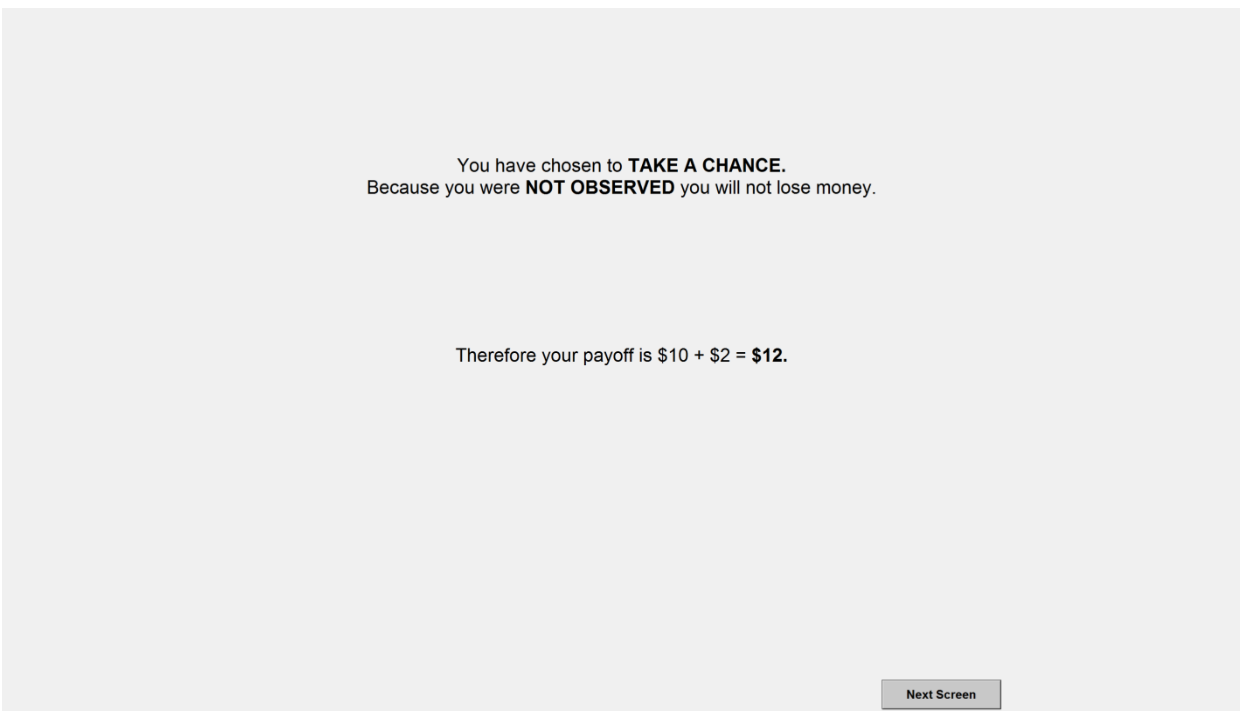
If you choose to **TAKE A CHANCE** and are **OBSERVED** **<u>and</u>** it is the first time you have chosen to **TAKE A CHANCE** and have been **OBSERVED** in the 1st period, you will lose **$1.** If you choose to **TAKE A CHANCE** and are **OBSERVED** **<u>and</u>** it is the second time you have chosen to **TAKE A CHANCE.** and have been **OBSERVED** in the 1st period, you will lose **$9.**

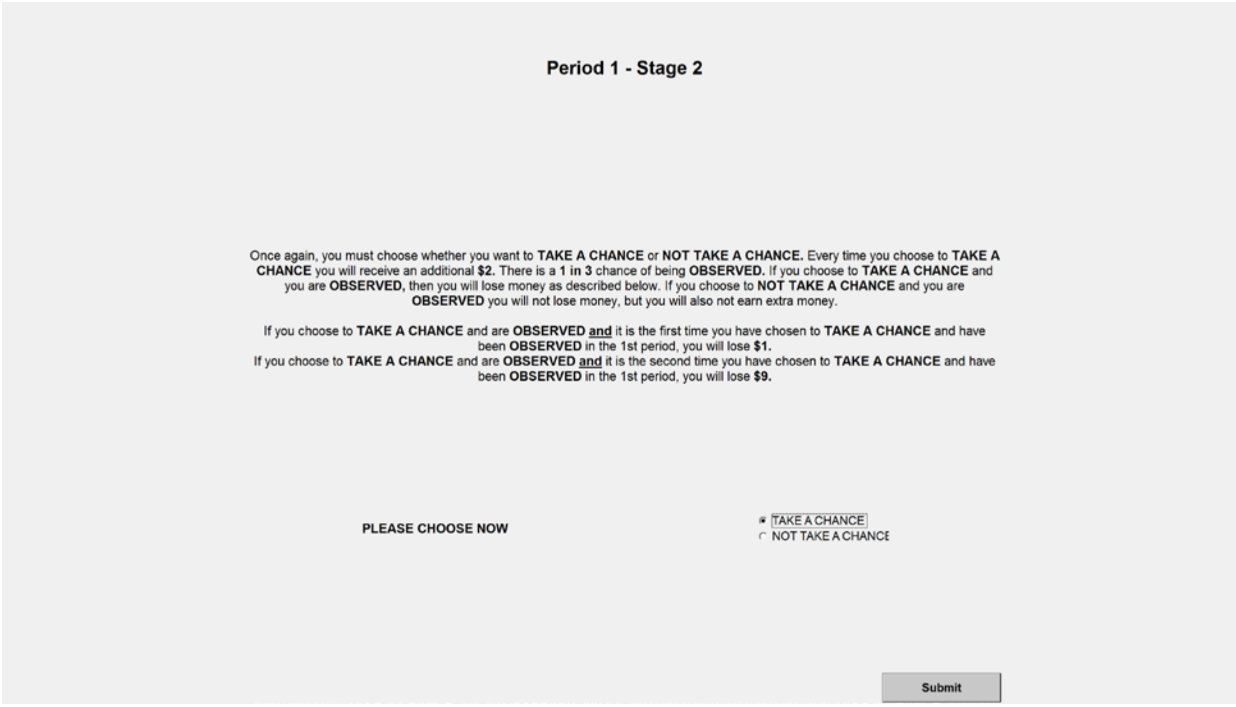
PLEASE CHOOSE NOW

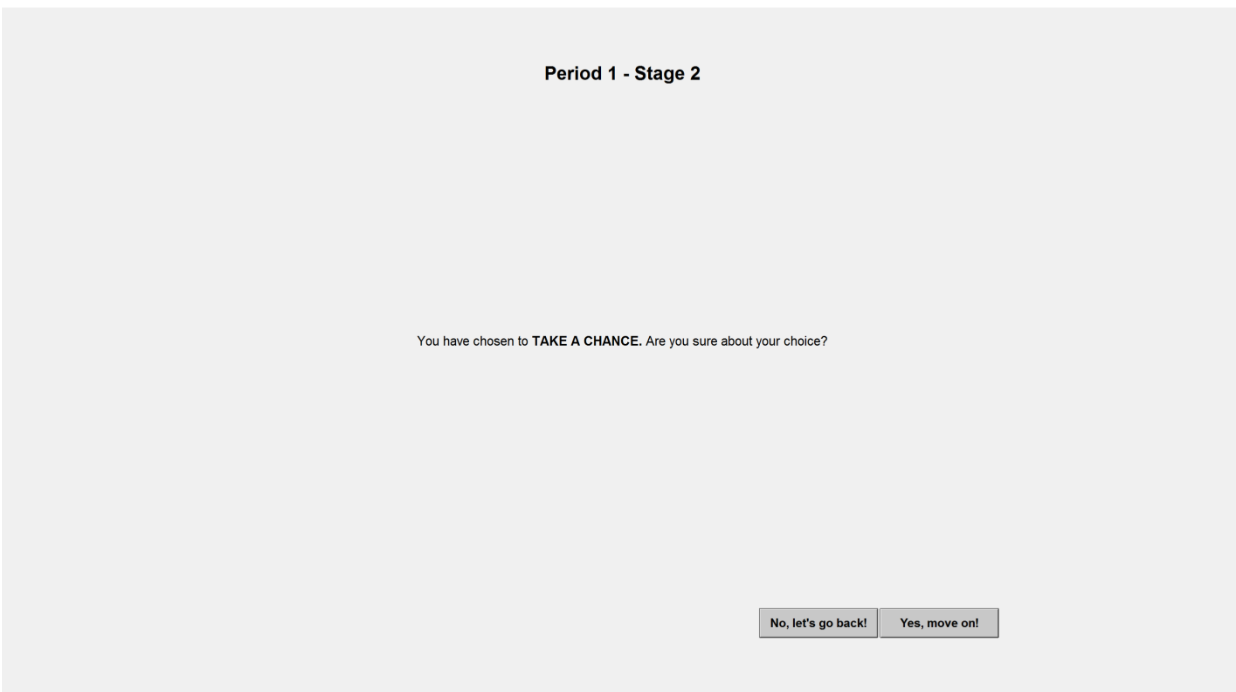
TAKE A CHANCE
NOT TAKE A CHANCE

Submit


Period 1 - Stage 1
You have chosen to **TAKE A CHANCE.** Are you sure about your choice?
No, let's go back!
Yes, move on!


You have chosen to **TAKE A CHANCE.**
Because you were **NOT OBSERVED** you will not lose money.
Therefore your payoff is $10 + $2 = **$12.**
Next Screen


Period 1 - Stage 2
Once again, you must choose whether you want to TAKE A CHANCE or NOT TAKE A CHANCE. Every time you choose to TAKE A CHANCE you will receive an additional $2. There is a 1 in 3 chance of being OBSERVED. If you choose to TAKE A CHANCE and you are OBSERVED, then you will lose money as described below. If you choose to NOT TAKE A CHANCE and you are OBSERVED you will not lose money, but you will also not earn extra money.
If you choose to TAKE A CHANCE and are OBSERVED and it is the first time you have chosen to TAKE A CHANCE and have been OBSERVED in the 1st period, you will lose $1.
If you choose to TAKE A CHANCE and are OBSERVED and it is the second time you have chosen to TAKE A CHANCE and have been OBSERVED in the 1st period, you will lose $9.
PLEASE CHOOSE NOW
TAKE A CHANCE
NOT TAKE A CHANCE
Submit


Period 1 - Stage 2
You have chosen to TAKE A CHANCE. Are you sure about your choice?
No, let's go back!
Yes, move on!

You have chosen to **TAKE A CHANCE.**
Because you were **OBSERVED** you will lose money.

Therefore your payoff for this period is **$13**

Next Screen

This is the 2nd period!

Next Screen

Before we start the 2nd period, we would like to know what your strategy will most likely look like. The table below will help you understand the payoff that you will receive for different possible decisions.

You begin with an initial payment of **$10.**
If you are **OBSERVED** and it is the first time you have been **OSBERVED** in this practice period, you will lose **$3.**
If you are **OBSERVED** and it is the second time you have been **OBSERVED** in this practice period, you will lose **$7.**

In the 1st stage:

If you choose to **TAKE A CHANCE**

- and you are **OBSERVED,** you will have
$9 (= $10 + $2 - $3)

- and you are **NOT OBSERVED,** you will have
$12 (= $10 + $2)

If you choose to **NOT TAKE A CHANCE**

You will have **$10.**

In the 2nd stage:

If you choose to **TAKE A CHANCE** again

- and you are **OBSERVED** , you will have:
$4 (= $9 + $2 - $ 7) (if this is the **2nd** time you are **observed**)
or
$11 (= $12 + $2 - $3) (if this is the **1st** time you are **observed**)

- and you are **NOT OBSERVED**, you will have
$11 (= $9 + $2) (if you were **observed** before)
or
$14 (= $12 + $2) (if you were **not observed** before.)

If you choose to **NOT TAKE A CHANCE** you will have

$9 (if in the 1st stage you were **observed**)
or
$12 (if in the 1st stage you were **not observed**).

If you choose to **TAKE A CHANCE**

- and you are **OBSERVED**, you will have
$9 (= $10 + $2 - $3)

- and you are **NOT OBSERVED**, you will have
$12 (= $10 + $2)

If you choose to **NOT TAKE A CHANCE** again

You will have
$10.

Next Screen

Before we start the 2nd period we would like to know what your strategy will most likely look like.

In every stage, if you choose to **TAKE A CHANCE** you will always receive an extra **$2** but you face a **1 in 3** chance of being **OBSERVED.**

If you choose to **TAKE A CHANCE** and are **OBSERVED** and it is the first time you have chosen to **TAKE A CHANCE <u>and</u>** have been **OBSERVED** in the 2nd period, you will lose **$3.** If you choose to **TAKE A CHANCE** and are **OBSERVED** and it is the second time you have chosen to **TAKE A CHANCE <u>and</u>** have been **OBSERVED** in the 2nd period, you will lose **$7.**

In the 1st stage I would most likely choose to

- TAKE A CHANCE
- NOT TAKE A CHANCE

Submit

Before we start the 2nd period we would like to know what your strategy will most likely look like.

In every stage, if you choose to **TAKE A CHANCE** you will always receive an extra **$2** but you face a **1 in 3** chance of being **OBSERVED.**

If you choose to **TAKE A CHANCE** and are **OBSERVED** and it is the first time you have chosen to **TAKE A CHANCE** <u>**and**</u> have been **OBSERVED** in the 2nd period, you will lose **$3.** If you choose to **TAKE A CHANCE** and are **OBSERVED** and it is the second time you have chosen to **TAKE A CHANCE** <u>**and**</u> have been **OBSERVED** in the 2nd period, you will lose **$7.**

	If I was **OBSERVED** in the 1st stage, in the 2nd stage I would most likely choose to	If I was **NOT OBSERVED** in the 1st stage, in the 2nd stage I would most likely choose to
In the 1st stage you chose to **TAKE A CHANCE.**	TAKE A CHANCE NOT TAKE A CHANCE	TAKE A CHANCE NOT TAKE A CHANCE

Submit

Period 2 - Stage 1

Remember: You begin with an initial payment of **$10.**

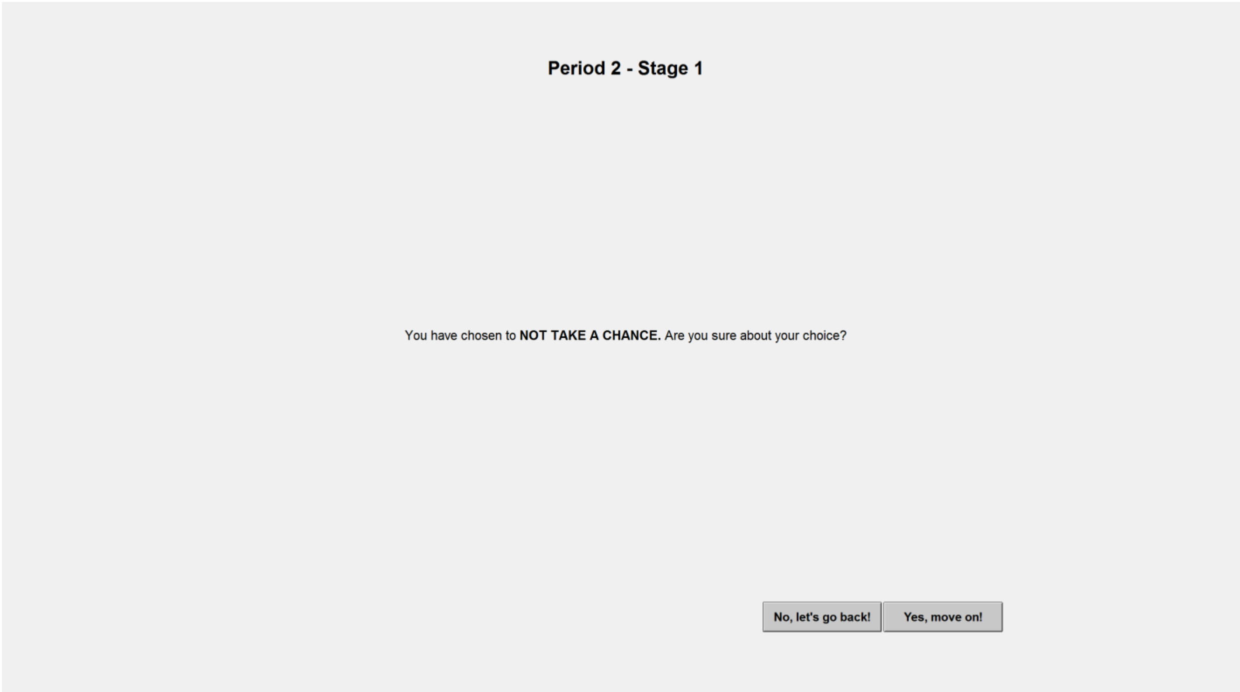
Every time you choose to **TAKE A CHANCE** you will receive an extra **$2.** In every stage you face a **1 in 3** chance of being **OBSERVED.** If you choose to **TAKE A CHANCE** and you are **OBSERVED,** then you will lose money as described below. If you choose to **NOT TAKE A CHANCE** and you are **OBSERVED,** then you will not lose money, but you also will not earn extra money. There is a possibility you will lose money if you choose to **TAKE A CHANCE** and are **OBSERVED.** (Note: In each stage you face the possibility of losing money **only** if you choose to **TAKE A CHANCE.** However, you will only earn extra money if you choose to **TAKE A CHANCE.**)

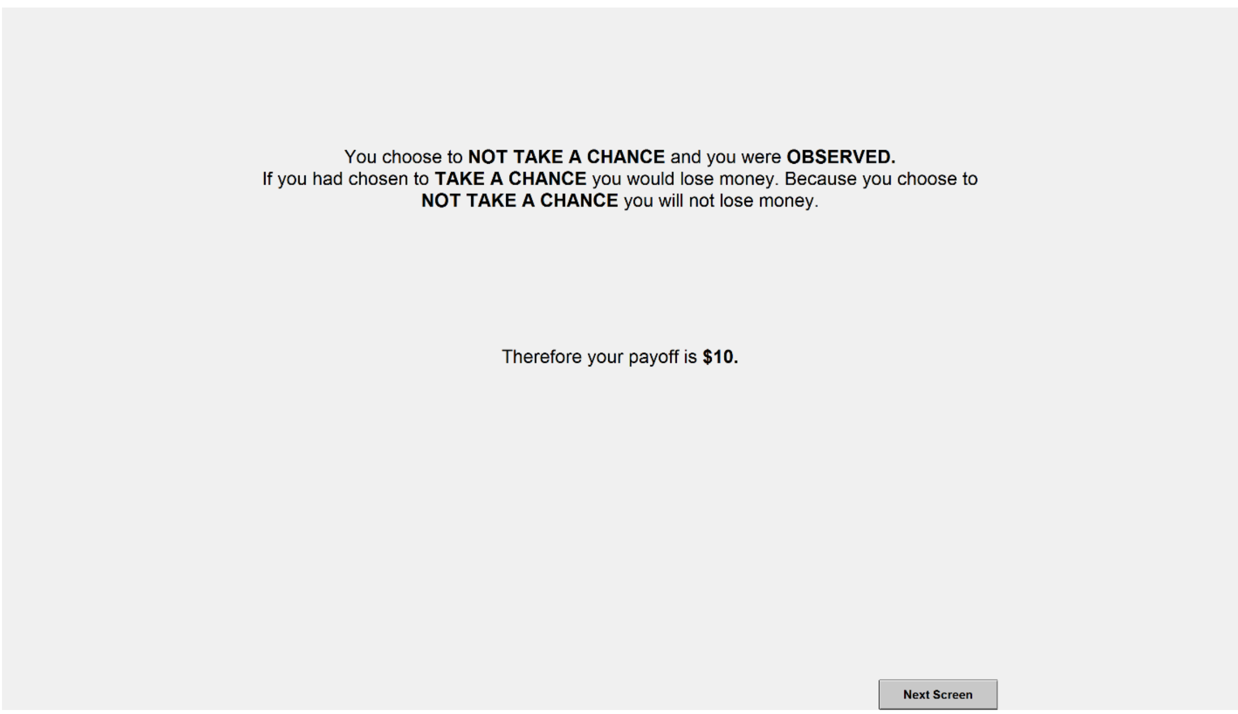
If you choose to **TAKE A CHANCE** and are **OBSERVED** <u>**and**</u> it is the first time you have chosen to **TAKE A CHANCE** and have been **OBSERVED** in the 2nd period, you will lose **$3.** If you choose to **TAKE A CHANCE** and are **OBSERVED** <u>**and**</u> it is the second time you have chosen to **TAKE A CHANCE.** and have been **OBSERVED** in the 2nd period, you will lose **$7.**

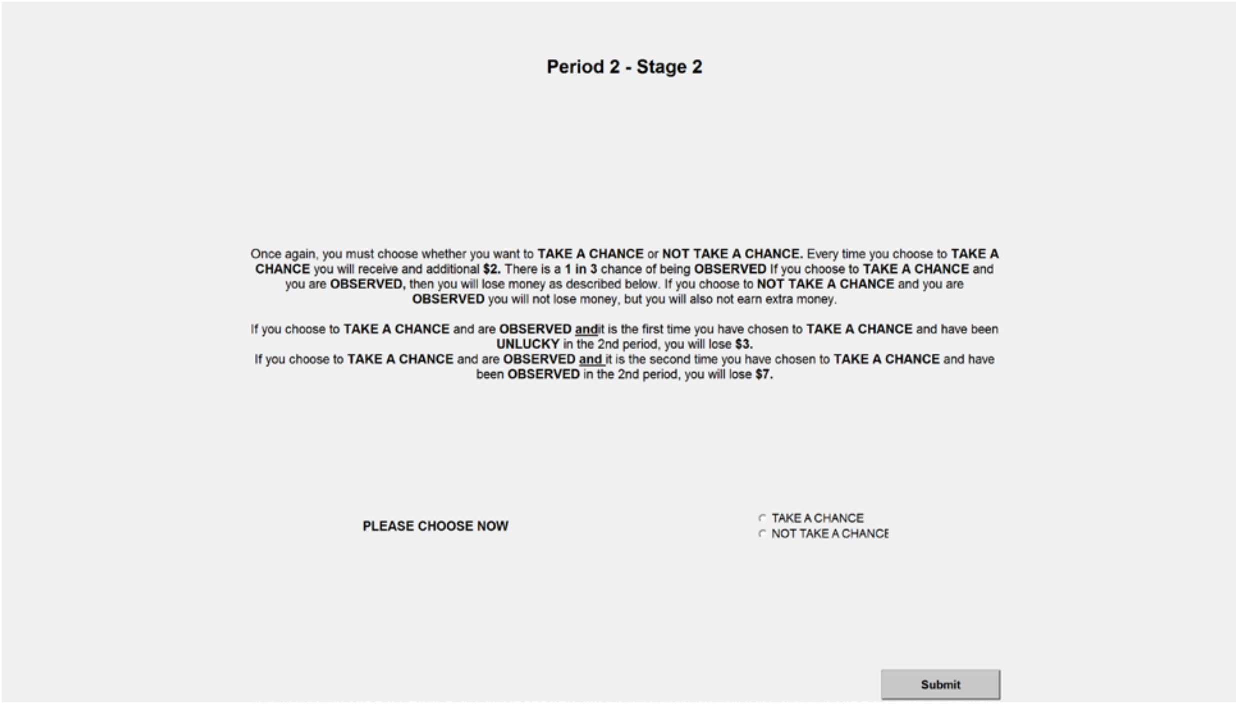
PLEASE CHOOSE NOW

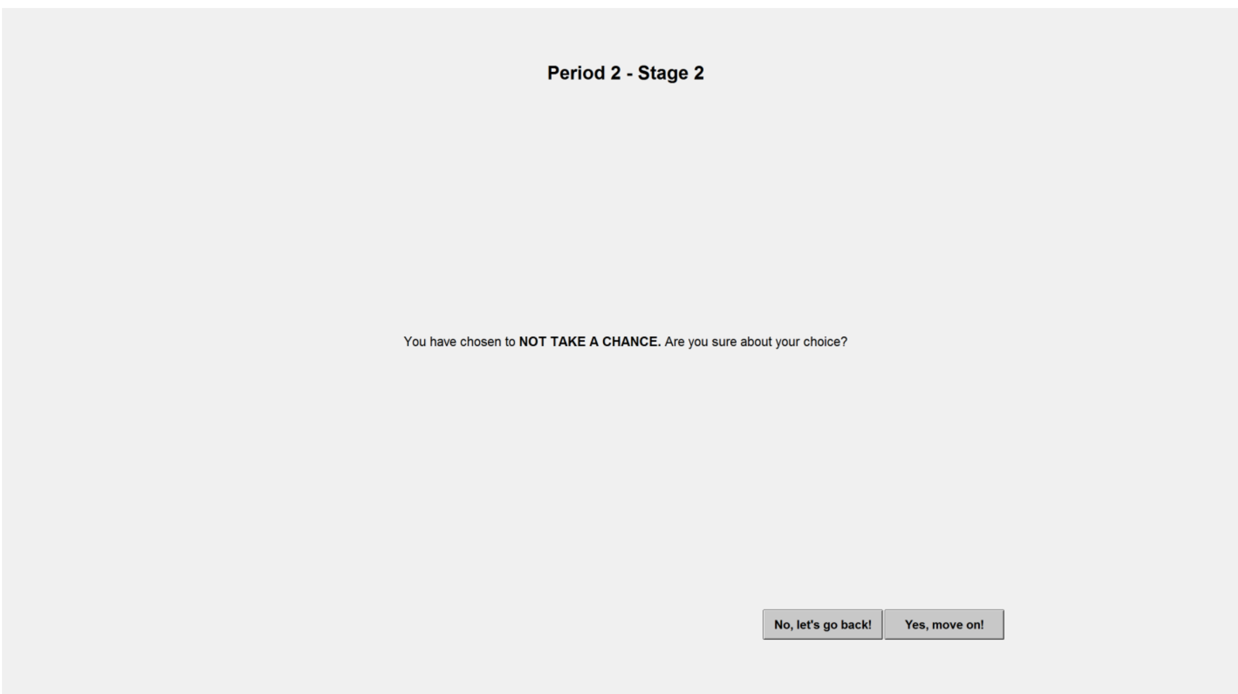
TAKE A CHANCE
NOT TAKE A CHANCE

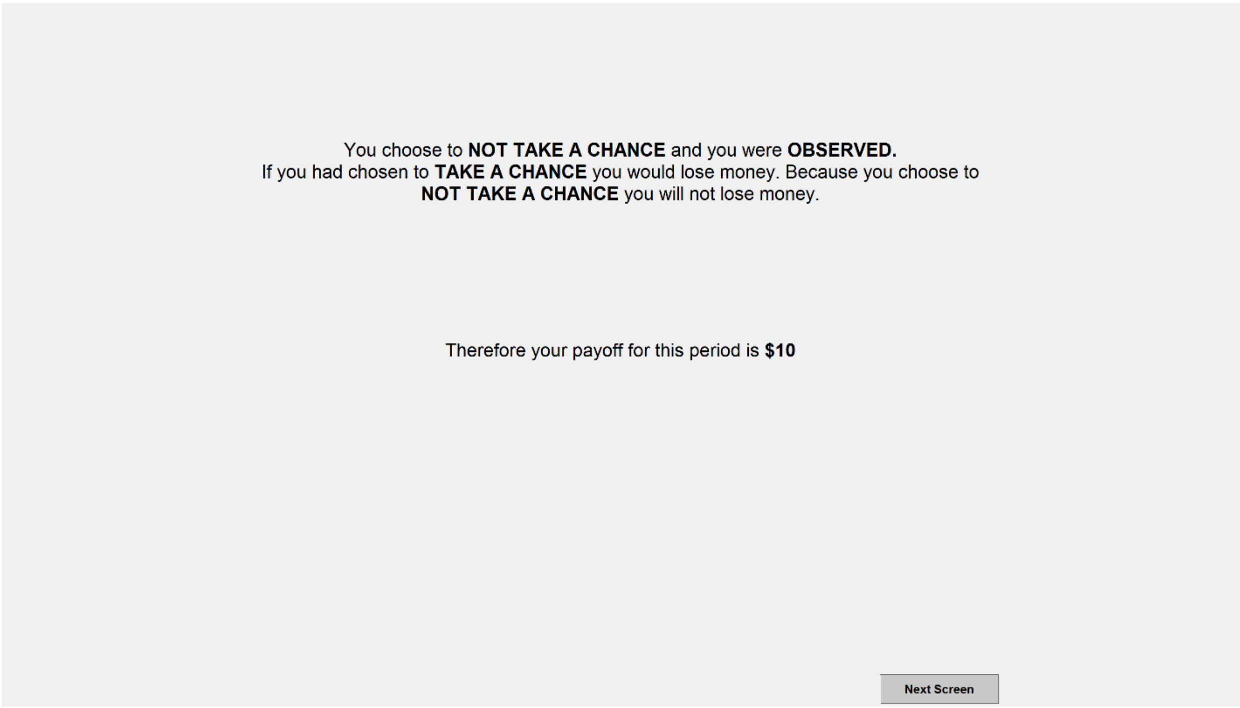
Submit


Period 2 - Stage 1
You have chosen to NOT TAKE A CHANCE. Are you sure about your choice?
No, let's go back!
Yes, move on!


You choose to NOT TAKE A CHANCE and you were OBSERVED.
If you had chosen to TAKE A CHANCE you would lose money. Because you choose to
NOT TAKE A CHANCE you will not lose money.
Therefore your payoff is $10.
Next Screen


Period 2 - Stage 2
Once again, you must choose whether you want to TAKE A CHANCE or NOT TAKE A CHANCE. Every time you choose to TAKE A CHANCE you will receive and additional $2. There is a 1 in 3 chance of being OBSERVED If you choose to TAKE A CHANCE and you are OBSERVED, then you will lose money as described below. If you choose to NOT TAKE A CHANCE and you are OBSERVED you will not lose money, but you will also not earn extra money.
If you choose to TAKE A CHANCE and are OBSERVED andit is the first time you have chosen to TAKE A CHANCE and have been UNLUCKY in the 2nd period, you will lose $3.
If you choose to TAKE A CHANCE and are OBSERVED and it is the second time you have chosen to TAKE A CHANCE and have been OBSERVED in the 2nd period, you will lose $7.
PLEASE CHOOSE NOW
TAKE A CHANCE
NOT TAKE A CHANCE
Submit


Period 2 - Stage 2
You have chosen to NOT TAKE A CHANCE. Are you sure about your choice?
No, let's go back!
Yes, move on!


You choose to **NOT TAKE A CHANCE** and you were **OBSERVED.**
If you had chosen to **TAKE A CHANCE** you would lose money. Because you choose to
NOT TAKE A CHANCE you will not lose money.
Therefore your payoff for this period is **$10**
Next Screen